PAC MANAGER™ USER'S GUIDE
LEGACY EDITION

SNAP PAC R-Series Controllers
SNAP PAC S-Series Controllers
SNAP PAC Brains
SNAP Simple I/O™
SNAP Ethernet I/O™
SNAP Ultimate I/O™
E1 Brain Board
E2 Brain Board

Form 1714-070119—January 2007

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Introduction

About this Guide

Welcome to PAC Manager, the configuration and inspection tool for working with SNAP PAC, SNAP Simple, SNAP Ethernet, and SNAP Ultimate I/O units, SNAP PAC controllers, and E1 and E2 brain boards.

Products Covered

This guide shows you how to configure and work with the following Opto 22 devices using the software tool PAC Manager:

- SNAP PAC S-series controllers
- SNAP PAC R-series controllers
- SNAP PAC EB brains
- SNAP Ultimate I/O
- SNAP Ethernet I/O
- SNAP Simple I/O
- E1 and E2 units

PAC Manager is on the CD that came with your hardware, and it is also available for download from our website, www.opto22.com.

This Legacy Edition includes both SNAP PAC hardware and current hardware. If you are using only SNAP PAC hardware, use form #1704, the *PAC Manager User's Guide*, instead of this guide.

NOTE: PAC Manager is only for units that communicate using Ethernet. To configure legacy mistic I/O units that communicate serially with a PAC Project controller (such as the SNAP-PAC-S1), use PAC Control. See Opto 22 form #1710, the PAC Control User's Guide, Legacy Edition, for instructions.

NOTE: SNAP-LCE controllers are not supported by PAC Manager, but by ioManager. For a SNAP-LCE, see form #1440, the ioManager User's Guide.

Contents

This guide assumes that you have some familiarity with TCP/IP, UDP/IP, and Ethernet networking. If you are not familiar with these subjects, we strongly suggest you consult commercially available resources to learn about them before attempting to use these systems.

This user's guide includes the following sections:

Chapter 1, "Introduction"—information about the guide and how to reach Opto 22 Product Support. Also includes product comparison charts.

Chapter 2, "Configuring Devices"—how to assign an IP address to your hardware, how to configure I/O units and I/O points, how to use I/O point features such as counters, watchdogs, and analog scaling; and how to send configuration data to I/O units.

Chapter 3, "Configuring Optional Functions"—information on configuring security, communication protocols like SNMP and PPP, streaming, the Scratch Pad area, and other optional functions.

Chapter 4, "Setting Up Events and Reactions"—if you are not using PAC Control, information on configuring local reactions to local events.

Chapter 5, "Reading and Writing to Specific Devices"—how to read data directly from a specific controller or I/O unit or write directly to a controller, brain, or I/O points.

Chapter 6, "Maintaining Devices"—changing IP addresses, upgrading firmware, and working with files on the device.

Chapter 7, "Troubleshooting"—tips for resolving difficulties you may encounter while working in PAC Manager.

Information Key

This guide includes information that applies to some types of controllers and I/O units but not to others. Sections are marked as follows to indicate the products that support them:

This text	Indicates support by this hardware
PAC-R	SNAP PAC R-series controllers
PAC-S	SNAP PAC S-series controllers
EB	SNAP PAC EB brains
UIO	SNAP Ultimate I/O
EIO	SNAP Ethernet I/O
SIO	SNAP Simple I/O
E1	E1 brain boards
E2	E2 brain boards

Related Documentation

You may also need some of the following documentation, depending on the system you are using and how you expect to communicate with it:

To use this	See this	Opto 22 form #
Current Hardware and Software		
SNAP PAC R-series controller	*SNAP PAC R-Series Controller User's Guide* *OptoMMP Protocol Guide*	1595 1465
SNAP PAC S-series controller	*SNAP PAC S-Series Controller User's Guide* *OptoMMP Protocol Guide*	1592 1465
SNAP PAC brains	*SNAP PAC Brain User's Guide* *OptoMMP Protocol Guide*	1690 1465
PAC Control strategies	*PAC Control User's Guide* *PAC Control Command Reference* *PAC Control Commands Quick Reference Card*	1700 1701 1703
Serial communication modules	*SNAP Serial Communication Module User's Guide*	1191
High-density digital modules	*SNAP High-Density Digital Module User's Guide*	1547
Legacy Hardware and Software		
E1 or E2 brain board	*E1 and E2 User's Guide* *Optomux Protocol Guide* *OptoMMP Protocol Guide*	1563 1572 1465
SNAP Ultimate I/O SNAP Ethernet I/O SNAP Simple I/O	*SNAP Ethernet-Based I/O Units User's Guide* *OptoMMP Protocol Guide*	1460 1465
ioControl strategies	*ioControl User's Guide* *ioControl Command Reference* *ioControl Commands Quick Reference Card*	1300 1301 1314

Some of this documentation is on the CD that came with your hardware; all forms are available on our website (www.opto22.com) for downloading. The easiest way to find one is to search on the form number.

For Help

If you have problems installing or using PAC Manager and cannot find the help you need in this guide or on our website, contact Opto 22 Product Support.

Phone:	800-TEK-OPTO (835-6786) 951-695-3080 (Hours are Monday through Friday, 7 a.m. to 5 p.m. Pacific Time)
Fax:	951-695-3017
Email:	support@opto22.com
Opto 22 website:	www.opto22.com

NOTE: Email messages and phone calls to Opto 22 Product Support are grouped together and answered in the order received.

When calling for technical support, be prepared to provide the following information about your system to the Product Support engineer:

- Software and version being used
- PC configuration (type of processor, speed, memory, and operating system)
- A complete description of your hardware and operating systems, including:
  - loader and firmware versions for the controller or brain, and device type (see page 212)
  - IP addresses and net masks for devices on the system
  - accessories installed (such as expansion cards)
  - type of power supply
  - third-party devices installed (for example, barcode readers)
- Specific error messages seen

Ethernet-Based I/O Processor Comparison Chart

Some of the features mentioned in this guide apply to some models and not others. (Note that in the case of the E1 and E2, additional features are available if these brain boards are used with the Optomux protocol. See the *E1 and E2 User's Guide*, form #1563, for more information.)

FEATURE		Current Hardware				Legacy Hardware							
		SNAP PAC Controller		SNAP PAC Brain				SNAP Simple	SNAP Ethernet		SNAP Ultimate		
		SNAP-PAC-R1	SNAP-PAC-R2	SNAP-PAC-EB1	SNAP-PAC-EB2	E1 Brain Board	E2 Brain Board	SNAP-ENET-S64	SNAP-B3000-ENET SNAP-ENET-RTC	SNAP-ENET-D64	SNAP-UP1-ADS	SNAP-UP1-D64	SNAP-UP1-M64
Digital I/O points	Input latching	●	●	●	●	●		●	●	●	●	●	●
	Watchdog timer[1]	●	●	●	●	●		●	●	●	●	●	●
	On/off status	●	●	●	●	●		●	●	●	●	●	●
	High-speed counters (up to 20 kHz)[1]	●		●					●		●		
	Quadrature counters	●		●					●		●		
	On-pulse and off-pulse measurement	●[1,2]		●[1,2]					●[1,3]		●[1,3]		
	TPO (time-proportional output)	●[2]		●[2]					●[3]		●[3]		
	Pulse generation (N pulses, continuous square wave, on-pulse, off-pulse)	●[2]		●[2]					●[3]		●[3]		
Analog I/O points	Thermocouple linearization (32-bit floating point for linearized values)	●	●	●	●		●	●	●		●		●
	Minimum/maximum values	●	●	●	●		●	●	●		●		●
	Offset and gain	●	●	●	●		●	●	●		●		●
	Scaling	●	●	●	●		●	●	●		●		●
	Time-proportional output	●	●	●	●			●	●		●		●
	Output clamping	●	●	●	●		●	●	●		●		●
	Filter weight	●	●	●	●			●	●		●		●
	Watchdog timer	●	●	●	●			●	●		●		●
	Ramping	●[2]		●[2]			●		●[3]		●[3]		
SNAP high-density digital modules		●	●	●	●			●	●		●		●
SNAP analog modules with more than 4 channels		●	●	●	●			●			●		●
Serial communication modules		●	●	●	●			●	●		●		●
Ethernet network		●	●	●	●	●	●	●	●	●	●	●	●
Two independent Ethernet interfaces (two IP addresses)		●	●										
Two switched Ethernet interfaces (one IP address)				●	●								
Serial network (RS-485/422)						●	●						

FEATURE		Current Hardware				Legacy Hardware							
		SNAP PAC Controller		SNAP PAC Brain				SNAP Simple	SNAP Ethernet		SNAP Ultimate		
		SNAP-PAC-R1	SNAP-PAC-R2	SNAP-PAC-EB1	SNAP-PAC-EB2	E1 Brain Board	E2 Brain Board	SNAP-ENET-S64	SNAP-B3000-ENET SNAP-ENET-RTC	SNAP-ENET-D64	SNAP-UP1-ADS	SNAP-UP1-D64	SNAP-UP1-M64
Serial ports (RS-232) for PPP or serial devices		●	●								●	●	●
OptoMMP protocol (over Ethernet)		●	●	●	●	●	●	●	●	●	●	●	●
Optomux protocol (over Ethernet or serial)						●	●						
Modbus/TCP		●	●	●	●	●	●	●	●	●	●	●	●
Runs PAC Control strategies		●	●										
Compatible with PAC Control (using SNAP PAC controller)		●	●	●	●	●	●	4	4	4	4	4	4
Legacy software support	Runs ioControl strategies	●	●								●	●	●
	Compatible with ioControl (through SNAP PAC, SNAP-LCE, or SNAP Ultimate controller running ioControl)	●	●			●	●	●	●	●	●	●	●
	Compatible with OptoControl (through Opto 22 controller with Ethernet card)	5	5					●	●	●			
UDP Streaming		●	●	●	●			●	●	●	●	●	●
SNMP (network management of I/O & variables)		●	●	●	●				●	●	●	●	●
PPP (dial-up and radio modems)		●	●						●	●	●	●	●
FTP server and client[6]		●	●	●	●						●	●	●
Email (SMTP client)		●	●	●	●				●	●	●	●	●
OPC driver		●	●	●	●	●	●	●	●	●	●	●	●
Security (IP filtering, port access)		●	●	●	●	●	●	●	●	●	●	●	●
PID logic on the brain Number of PIDs available		● 96	● 96	● 32	● 32				● 16		● 32		● 32
Digital events		●	●	●	●				●	●	●	●	●
Alarm events		●	●	●	●				●		●		●
Serial events		●	●	●	●				●		●		●
Timed events		●	●	●	●				●	●	●	●	●
Event messages		●	●	●	●				●	●	●	●	●
Data logging in the brain		●	●	●	●				●		●		●
I/O point data mirroring		●	●	●	●				●		●		●
Memory map data copying		●	●	●	●				●		●		●

FEATURE	Current Hardware				Legacy Hardware							
	SNAP PAC Controller		SNAP PAC Brain				SNAP Simple	SNAP Ethernet		SNAP Ultimate		
	SNAP-PAC-R1	SNAP-PAC-R2	SNAP-PAC-EB1	SNAP-PAC-EB2	E1 Brain Board	E2 Brain Board	SNAP-ENET-S64	SNAP-B3000-ENET SNAP-ENET-RTC	SNAP-ENET-D64	SNAP-UP1-ADS	SNAP-UP1-D64	SNAP-UP1-M64
Scratch Pad area (peer-to-peer communication)												
Bits	●	●	●	●				●	●	●	●	●
Floats	●	●	●	●						●	●	●
Integers	●	●	●	●						●	●	●
Strings	●	●	●	●						●	●	●
Realtime clock (RTC)	●	●						●[7]		●	●	●

1 Available with 4-channel SNAP digital modules, not with high-density digital modules
2 Available when used with PAC Control Professional.
3 Available when used with PAC Control Professional and a SNAP PAC R- or S-series controller.
4 Limited compatibility as an I/O unit with PAC Control.
5 Converts OptoControl strategies to PAC Control, when used with PAC Control Professional.
6 FTP client provided by PAC Control strategy.
7 Applies to SNAP-ENET-RTC, not to SNAP-B3000-ENET.

Configuring Devices

Introduction

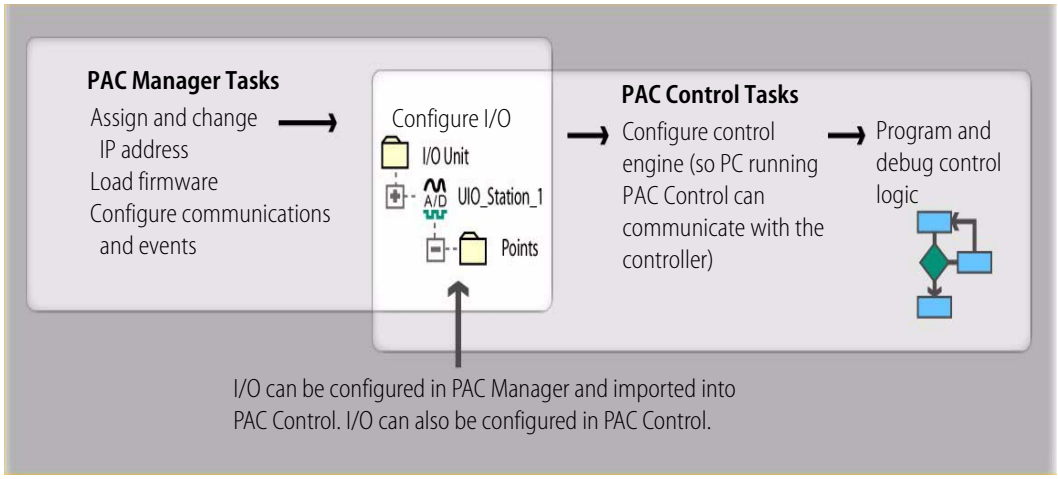
Follow the steps in this chapter to assign an IP address to a SNAP PAC controller or to an Ethernet-based I/O unit (SNAP PAC R-series, SNAP Ultimate, SNAP Ethernet, SNAP Simple, E1, or E2). This chapter also includes steps for configuring I/O unit points and features. The IP address is required for communication on the Ethernet network, and I/O points on an I/O unit must be configured before you can read or write to them.

This chapter assumes that you have already installed the hardware and software according to steps in the device's user's guide. (See "Related Documentation" on page 3.)

If you are using a modem connection, or if you are using event messages, email, streaming, the Scratch Pad area for peer-to-peer communication, or SNMP for communicating with enterprise management systems, also see Chapter 3, which shows you how to set up these optional functions. All this information goes in the configuration file that PAC Manager uploads to I/O units.

When to Use PAC Manager and PAC Control

If you will be running a PAC Control strategy on a SNAP PAC or SNAP Ultimate I/O system to control I/O units, you may be wondering when to use PAC Manager versus when to use PAC Control. These two tools serve different purposes, but some of their functionality overlaps:


PAC Manager Tasks
Assign and change IP address
Load firmware
Configure communications and events
Configure I/O
I/O Unit
A/D
UIO_Station_1
Points
PAC Control Tasks
Configure control engine (so PC running PAC Control can communicate with the controller)
Program and debug control logic
I/O can be configured in PAC Manager and imported into PAC Control. I/O can also be configured in PAC Control.

Configuring I/O

I/O units and points must be configured to match the PAC Control strategy you will run. You can configure most Ethernet-based I/O unit and point functions either in PAC Control or in PAC Manager.

IMPORTANT: *For E1 and E2 I/O units, you must use PAC Manager. See form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards, for instructions.*

*For **mistic I/O units**, PAC Manager cannot be used for configuration. Use PAC Control.*

For most I/O units, if you are already in PAC Control, configuration is easier there and you can use the loopback IP address for SNAP PAC R-series or SNAP Ultimate I/O units controlling themselves. However, some functions for I/O units cannot be configured in PAC Control.

If you use PAC Manager, you can save your configuration to a file, load it to multiple I/O units at once, and use it for referencing points in OPC. However, you cannot use the loopback address in PAC Manager and you cannot use PAC Manager for mistic I/O units.

Choose your configuration tool based on what you need to do:

Use PAC Control for I/O configuration if	Use PAC Manager for I/O configuration if
• You have only one I/O unit or I/O unit configurations are different. • You are configuring mistic I/O units. • The strategy will run on SNAP PAC R-series or SNAP Ultimate I/O units that are controlling themselves using the loopback IP address, 127.0.0.1 • You are using an Ethernet network for communications. (Exception: Use PAC Manager for E1 or E2 I/O units.) • The strategy handles all logic; you are not also configuring events and reactions on I/O units.	• You have multiple I/O units whose configurations are exactly the same or similar. • You are configuring an E1 or E2 I/O unit. • You are using a modem connection (PPP) or SNMP. • You are using event messages or email. • You are configuring events and reactions on the I/O unit in addition to strategy logic. • You are using OPC to communicate with I/O units. • You are not using PAC Control.

Whichever tool you use for configuring I/O, be aware of the impact if you later change configuration. For example, if you configure I/O in PAC Manager, download the configuration file to I/O units, and then later add a point in PAC Control, remember that your configuration file doesn't contain that point.

Assigning an IP Address

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

About IP Addresses

Each Ethernet-based device (controller, brain board, or brain) ships from the factory with a unique hardware Media Access Control (MAC) address and with a default IP address of 0.0.0.0, which is invalid. Each device must have a valid IP address and subnet mask so that it can communicate on the network.

Opto 22 Ethernet-based hardware falls into two categories that differ in the way IP addresses are assigned:

- SNAP PAC controllers and brains, SNAP Ultimate, SNAP Ethernet, and SNAP Simple I/O—When installed and first turned on, each of these devices sends out a BootP broadcast requesting an IP address. You respond to the broadcast by using PAC Manager to assign a *static* IP address. These devices must be given a fixed, static IP address, because you communicate with them using the IP address. See steps on page 11.
- E1 and E2 brain boards—When installed and first turned on, each E1 or E2 sends out a DHCP (Dynamic Host Configuration Protocol) broadcast requesting an IP address. Any DHCP server on the network can respond and assign a dynamic IP address to the brain board.

  In most cases, you will need to change the E1's or E2's dynamic IP address to a *static* IP address. You must give E1s and E2s static IP addresses if you are using PAC Project software (PAC Control, PAC Display, OptoOPCServer, or OptoDataLink), the OptoMMP Communication Toolkit, or the Optomux Driver Toolkit to communicate with them.

  However, if your application can communicate with E1s and E2s using host names, and your E1s and E2s are on a network that has a DHCP server that automatically updates a DNS (Dynamic Name Service) server, you do not have to assign a static IP address. You will communicate with the brain board using its host name.

  Whether you are using a dynamic or a static IP address for E1 and E2 brain boards, see the steps on page 16.

PAC-S
PAC-R
EB
UIO
EIO
SIO

Assigning IP Addresses to SNAP PAC, UIO, EIO, and SIO

SNAP PACR-series and S-series controllers, and SNAP PAC EB, SNAP Ultimate, SNAP Ethernet, and SNAP Simple I/O units must be assigned a unique, static IP address. If the network you're using has a Dynamic Host Configuration Protocol (DHCP) server, either assign a static IP address before connecting the device to the network (preferred), or disable the server. (These servers may respond to BootP requests and assign a dynamic address.)

CAUTION: *To make sure the controller or I/O unit is not on a network with a DHCP server, we recommend you use a crossover cable with a direct connection to assign IP addresses.*

TIP:
For multiple devices, see page 23.

If you are adding an I/O segment to an existing Ethernet network, your network administrator must provide static IP addresses and subnet masks for the I/O units. If you are creating an independent, dedicated Ethernet network just for I/O, you can choose your own addresses.

NOTE: BootP broadcasts cannot get through a firewall in the PC where PAC Manager is running. Make sure any firewall in the computer (such as the built-in firewall in Windows XP) is disabled before you try to assign IP addresses. Firewalls in a router should not be a problem.

1. Make sure that the Opto 22 hardware is installed according to directions in its user's guide, and that the PAC Manager software is installed on the PC.
2. Make sure you know the MAC address of each device that will receive an IP address.

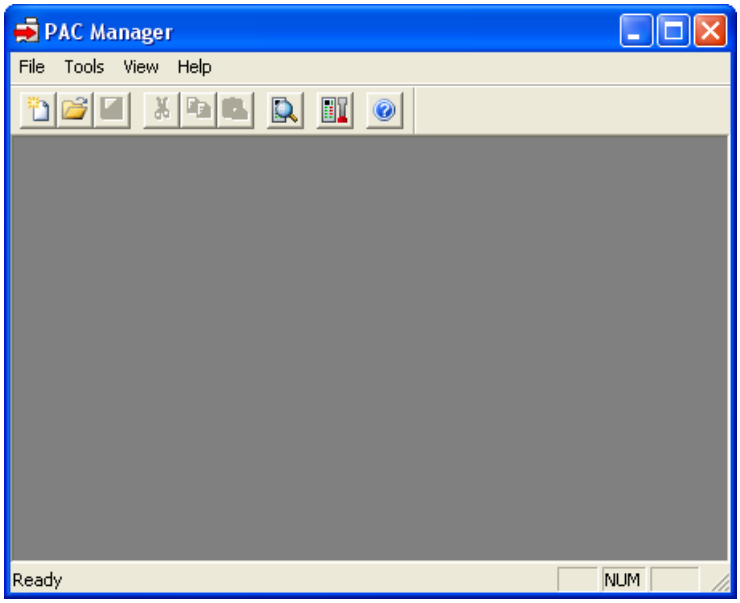
   The MAC address is on a label on the side of the controller or brain.

NOTE: SNAP PAC S-series and R-series controllers each have two separate Ethernet network interfaces; each interface has a separate MAC address and therefore takes a separate IP address. Only ENET1 sends a BootP request. Once you have assigned this primary IP address, you can assign the secondary address following the steps on page 28.

On SNAP PAC brains, however, the two Ethernet network interfaces act as an Ethernet switch and share the same IP address. It doesn't matter which interface is attached to the network, since the BootP broadcast comes through both.

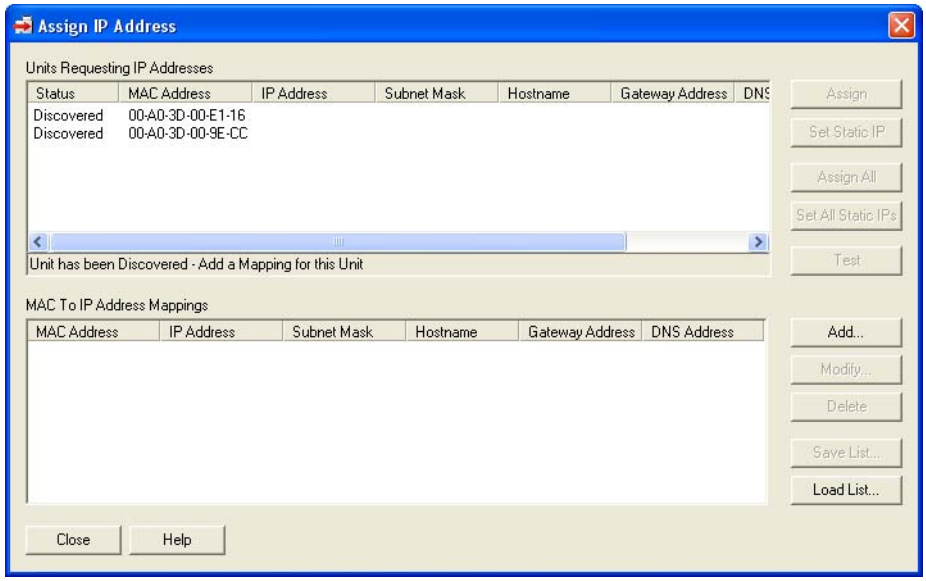
3. Turn on the Opto 22 device(s).
4. On the PC, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

   The PAC Manager main window opens:



5. From the Tools menu, choose Assign IP Address.

The following dialog box opens. Any Opto 22 Ethernet-based devices without IP addresses that are on the PC's network segment appear in the list of units requesting IP addresses:



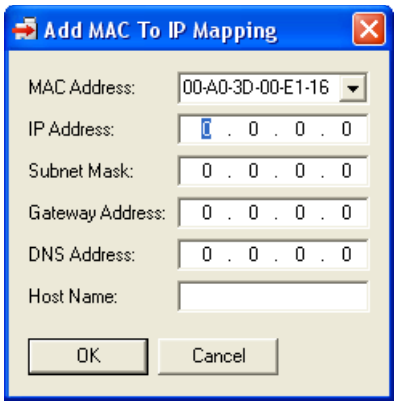
NOTE: If no MAC address appears, check the following:

- *Is the Opto 22 device turned on?*
- *Is it correctly connected to the PC using a crossover cable or correctly connected to an Ethernet hub using a straight-through cable? Is the PC on the same subnet as the device? See the PC's user's guide for networking information.*
- *Does the device already have an IP address? If you want to change the IP address, you can do so using the instructions on page 195.*
- *Is the device booting to the loader rather than the firmware? See its user's guide for more information.*
- *Does the PC have firewall software that blocks network broadcasts? If so, disable the software. (For Windows XP SP2, click Unblock at the Windows Security Alert naming PAC Manager.)*

6. Double-click the MAC address of the device in the list.

CAUTION: *PAC Manager lists ALL Opto 22 devices sending BootP or DHCP broadcasts. Assign IP addresses only to the ones you know are yours!*

The Mapping dialog box opens:



7. Enter the IP Address and the Subnet Mask for the device. If it will be talking to a device on another subnet, enter the Gateway (router) address. If it will talk only on the local subnet, leave the gateway address all zeros (0.0.0.0). Leave the DNS address at 0.0.0.0 and the Host Name field blank.

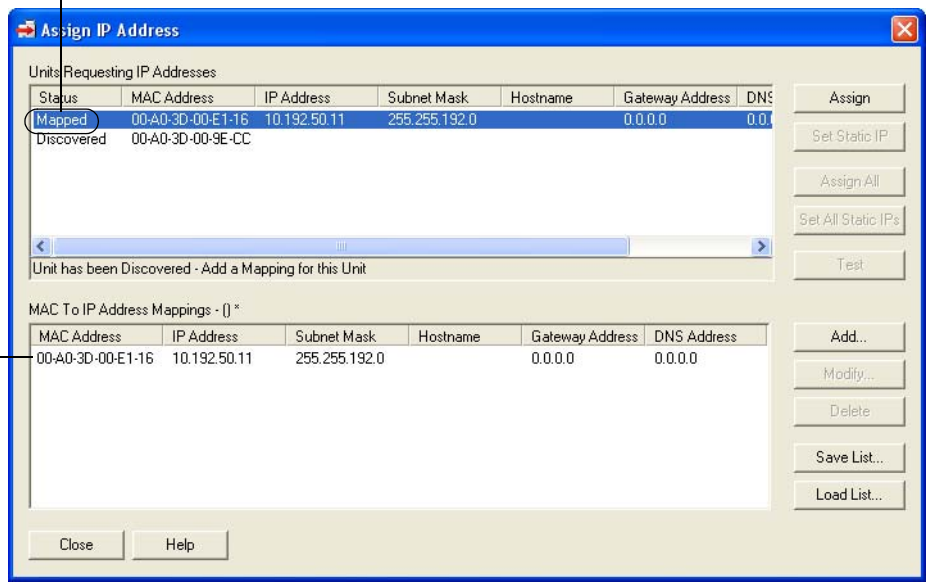
WARNING! *Each device on your network, including computers, routers, controllers, brains, and so on, must have a unique IP address. Failure to assign unique IP addresses may cause catastrophic network or hardware failures. If you don't know which IP addresses are safe to use, check with your system administrator.*

8. When the IP address, subnet mask, and other fields are correct, click OK.

The new IP address information appears in the upper list in the dialog box, and the device's status changes to Mapped. The address information also appears in the lower list to show that this device has been mapped to this address.

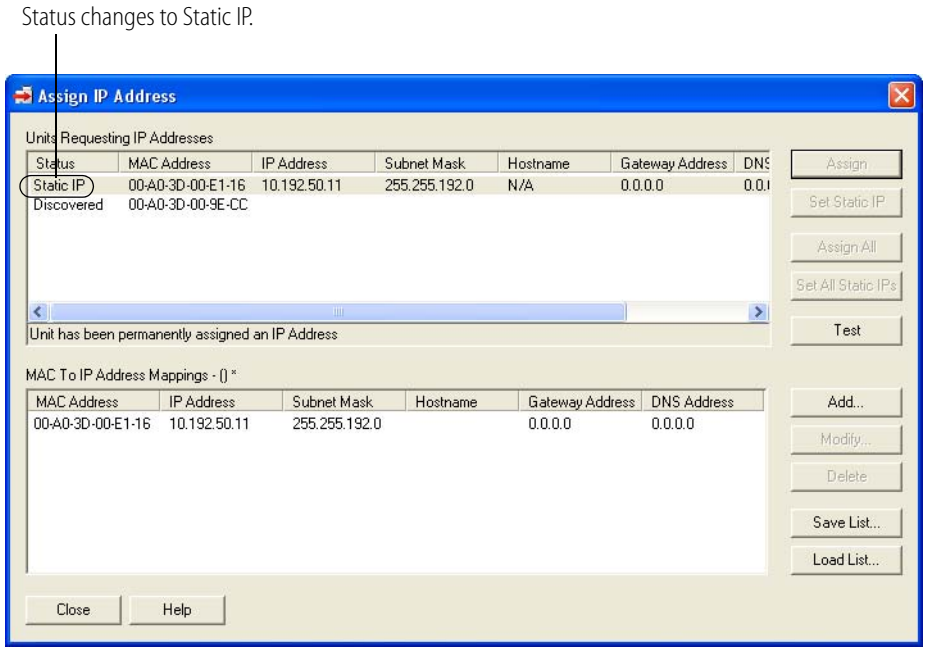
Status changes to Mapped.

Address data appears in lower list.



9. With the device still highlighted, click Assign.

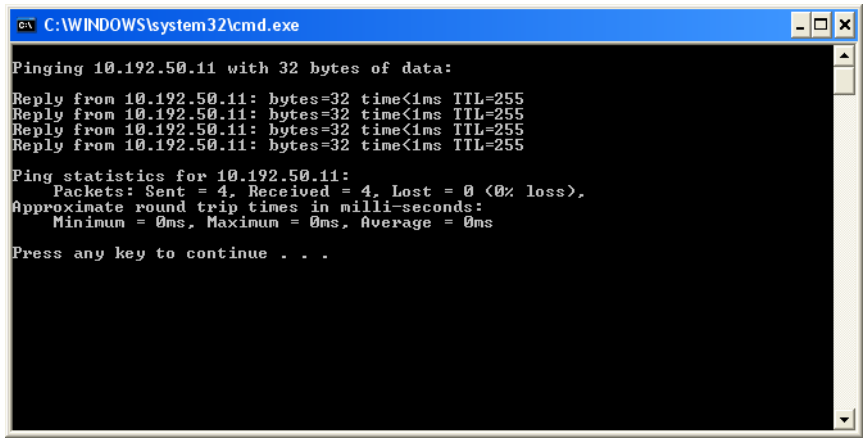
The address is saved to flash memory, and the status changes to Static IP.



NOTE: Once a device's status becomes Assigned or Static, you can no longer change its IP address information from this dialog box. To change the address, use Tools→Change IP Settings. (See page 195.)

10. To verify that the IP address has been successfully assigned, highlight the device in the upper list and click Test.

A DOS window opens and the IP address is automatically contacted using the PING program. You should see a reply similar to the following:


C:\WINDOWS\system32\cmd.exe
Pinging 10.192.50.11 with 32 bytes of data:
Reply from 10.192.50.11: bytes=32 time<1ms TTL=255
Reply from 10.192.50.11: bytes=32 time<1ms TTL=255
Reply from 10.192.50.11: bytes=32 time<1ms TTL=255
Reply from 10.192.50.11: bytes=32 time<1ms TTL=255
Ping statistics for 10.192.50.11:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
Press any key to continue . . .

If you don't see a reply, make sure the subnet mask you've assigned matches the subnet mask on your PC.

11. For future reference, write the IP address next to the MAC address on the white sticker provided on the device.
12. Repeat steps 6 through 11 for any other devices in the list that you are responsible for.
13. To save the list of IP address and MAC address mappings (the lower list in the dialog box) for future reference, click the Save List button. Navigate to the folder where you want to save the file, enter a filename, and click Save.

    The address information is saved. You can load this information into PAC Manager later if you need to see it.
14. For a SNAP PAC R-series controller, to assign a secondary IP address, see page 28. Then continue with "Creating an I/O Unit Configuration File" on page 32.
15. For a SNAP PAC EB, SNAP Ultimate, SNAP Ethernet, or SNAP Simple I/O unit, continue with "Creating an I/O Unit Configuration File" on page 32.
16. For a SNAP PAC S-series controller, choose from the following:
    - To set up security, see page 76.
    - (SNAP PAC only) To assign a secondary IP address, see page 28.
    - To create PAC Control strategies to run on the controller, see the *PAC Control User's Guide* and the *PAC Control Command Reference*. Information on peer-to-peer communication using the Scratch Pad area of the controller can be found in "Communication Commands" in Chapter 10 of the *PAC Control User's Guide*.
    - To work with the controller's file system and FTP, see page 202.

E1
E2

Assigning IP Addresses to E1 and E2 I/O Units

Remember that any E1 or E2 used with PAC Project software (PAC Control, PAC Display, OptoOPCServer, or OptoDataLink) or applications built with the OptoMMP Communication Toolkit or the Optomux Driver Toolkit must be assigned a static IP address, because you will use the IP address to communicate with the device.

Discovering the IP Address

TIP:
For multiple devices, see page 23.

1. Make sure you know the MAC address of the E1 or E2.

   The MAC address is printed on a white sticker on the brain board.
2. Make sure that the Opto 22 hardware is installed according to directions in its user's guide.
3. Turn on the E1 or E2 I/O unit.

   The I/O unit sends a DHCP broadcast. The broadcast is usually answered by a DHCP server on the network, and the server assigns a dynamic IP address.
4. On a PC on the same network, open a Command Prompt. Type `ping` and the host name of the I/O unit.

   The default host name for any E1 or E2 is `OPTO-` followed by the last six digits of the brain board's MAC address. For example, an E1 with a MAC address of 00-a0-3d-00-09-35 would

have this default host name: `OPTO-00-09-35` So in the command prompt, you would type: `ping OPTO-00-09-35`

If the ping command works, you know that the I/O unit has been assigned an IP address. The current IP address of the device is returned to you in the reply.

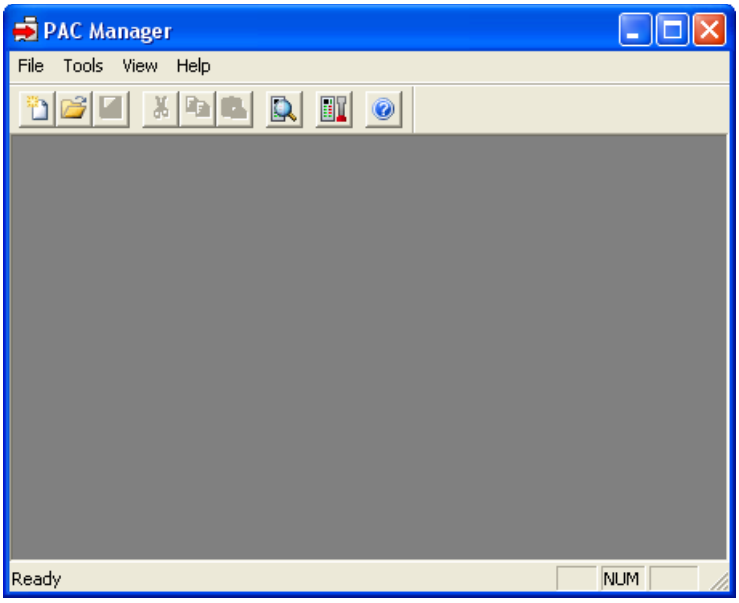
5. Choose one of the following:
   - If the ping command worked and you need to assign a static IP address, write down the IP address from the ping reply. Continue with "Changing the IP Address to a Static IP" on page 19.
   - If the ping command worked and you will communicate with the device using only its host name rather than its IP address, the device is ready to use. Stop here. (You can change the host name if necessary. See "Changing Status Data" on page 151.)
   - If the ping command did not return a reply, continue with the next step.

   CAUTION: *You may have problems continuing with the next step if your network includes old Opto 22 SNAP Ethernet brains with firmware version R1.3m or earlier, or controllers with M4SENET-100 adapter cards at firmware version R1.3k or earlier. These brains and adapter cards may have to be rebooted if you use the discovery feature in the next steps.*

   To avoid this problem, either update the older devices to newer firmware before continuing, or ask your network administrator to provide you with the dynamic IP address currently assigned to the E1 or E2, and then skip to "Changing the IP Address to a Static IP" on page 19.

6. If the ping command did not return a reply, make sure that PAC Manager software is installed on a PC on the same network as the brain board.
7. On the PC, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

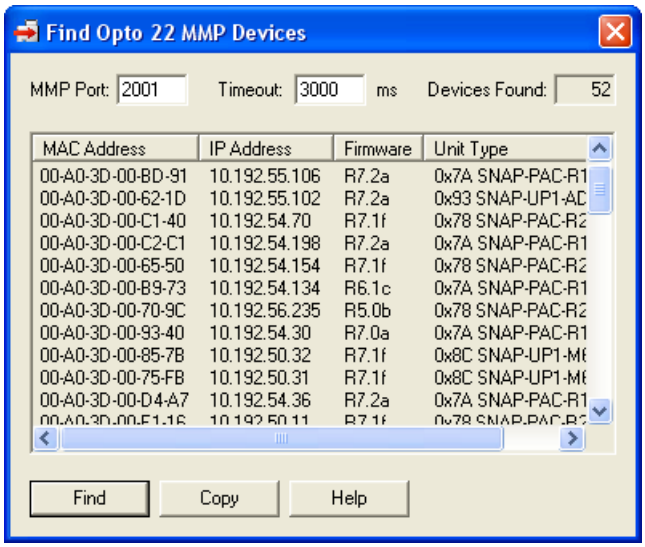
   The PAC Manager main window opens:



8. Choose Tools→Find Opto 22 MMP Devices.

9. Click Find.

   PAC Manager discovers all Opto 22 memory-mapped devices on the network and lists their MAC addresses and IP addresses. Opto 22 memory-mapped devices include SNAP PAC controllers and brains, SNAP Ethernet, SNAP Ultimate, and SNAP Simple I/O units, and E1 and E2 I/O units. (Opto 22 M4-series controllers with Ethernet cards are not included.)



10. Find the device's MAC address in the left column and write down its IP address from the next column. Make sure you have the correct MAC address!
11. Close the dialog box.
12. Continue with the next section, "Changing the IP Address to a Static IP."

E1
E2

Changing the IP Address to a Static IP

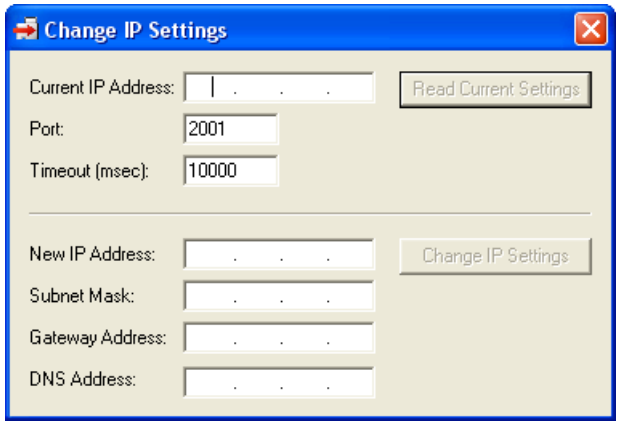
1. Make sure you know the current IP address of each device as well as the static IP address number and subnet mask to assign to it.

   You should already know the current IP address from steps in the previous section, "Discovering the IP Address" on page 16. Work with your network administrator to determine the static IP addresses to use for your Ethernet network.

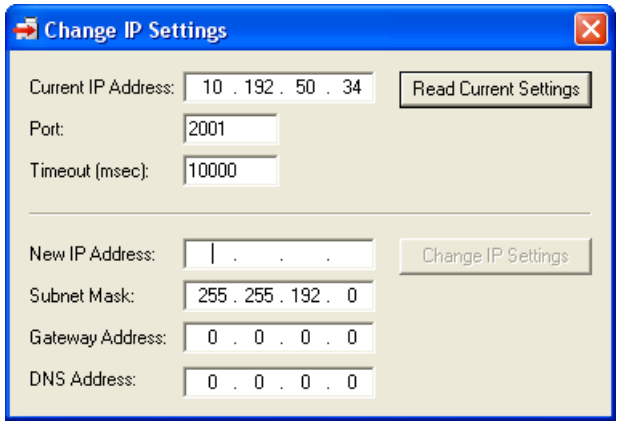
2. If PAC Manager is not open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

   The PAC Manager main window opens.

3. Choose Tools→Change IP Settings.



4. Enter the current IP address and click Read Current Settings to see the current subnet mask, gateway address, and DNS address.



5. Enter the new IP address and subnet mask. If the brain board will be talking to a device on another subnet, enter the Gateway (router) address. If it will talk only on the local subnet, leave the gateway address all zeros (0.0.0.0). Leave the DNS address at 0.0.0.0. When everything is correct, click Change IP Settings.

After you confirm the change, a message appears stating that the change was successful and that the I/O unit will restart. Restarting may take 10 to 20 seconds to finish.

6. Do not disturb the E1 or E2 while its STATUS LED is blinking.

   When the STATUS LED stops blinking and stays on, the device is ready for use with its new static IP address.

7. For future reference, write the IP address on the white area on the brain board, just below the MAC address.

E1
E2

Assigning a Static IP Address

These steps assume that you have already tried to discover the E1 or E2's IP address (see page 16) and have not been able to find it out. This situation indicates that there is no active DHCP server on the network and therefore the device does not yet have an IP address assigned.

1. Make sure you know the MAC address of each device and the static IP address number and subnet mask to assign to it.

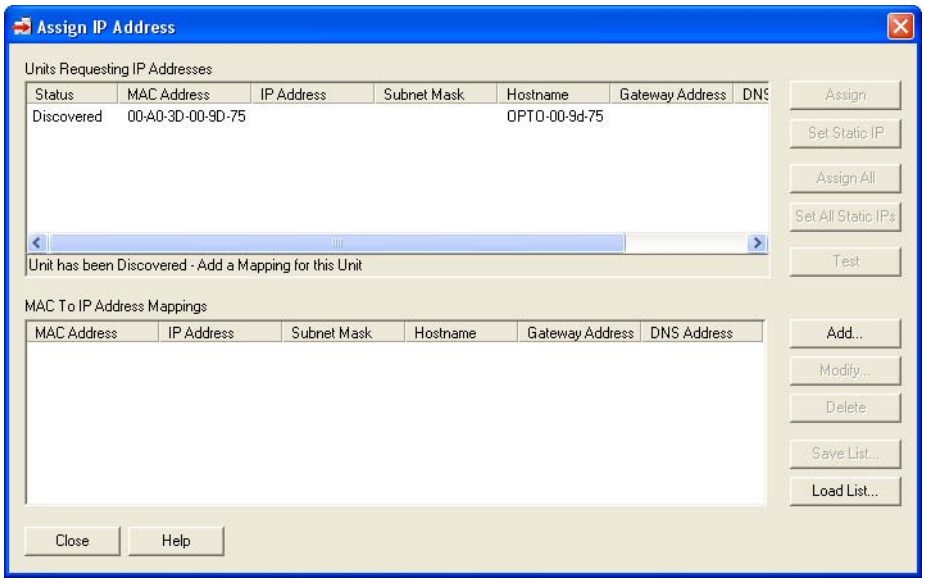
   The MAC address is printed on a white area on the brain board. Work with your network administrator to determine static IP addresses.

2. Make sure that PAC Manager software is installed on a PC on the same network as the brain board. If PAC Manager is not open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

   The PAC Manager main window opens.

3. Choose Tools→Assign IP Address.

   The following dialog box opens. Any Opto 22 Ethernet-based devices without IP addresses that are on the PC's network segment appear in the list of units requesting IP addresses:



NOTE: If no MAC address appears, check the following:

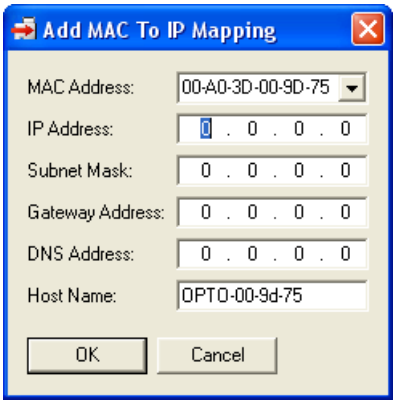
- *Is the Opto 22 device turned on?*

- *Is it correctly connected to the PC using a crossover cable or correctly connected to an Ethernet hub using a straight-through cable? Is the PC on the same subnet as the device? See its user's guide for networking information.*
- *Does the device already have an IP address? If you want to change the IP address, you can do so using the instructions on page 195.*
- *Is the device booting to the loader rather than the firmware? See its user's guide for more information.*
- *Does the PC have firewall software that blocks network broadcasts? If so, disable the software. (For Windows XP SP2, click Unblock at the Windows Security Alert naming* PAC Manager.*)*

4. Double-click the MAC address of the device in the list.

CAUTION: PAC Manager *lists ALL Opto 22 devices sending BootP or DHCP broadcasts. Assign IP addresses only to the ones you know are yours! Hint: E1s and E2s show a host name that is OPTO- plus the last six digits of the MAC address (for example:* `OPTO-00-9D-75`*).*

The Mapping dialog box opens:

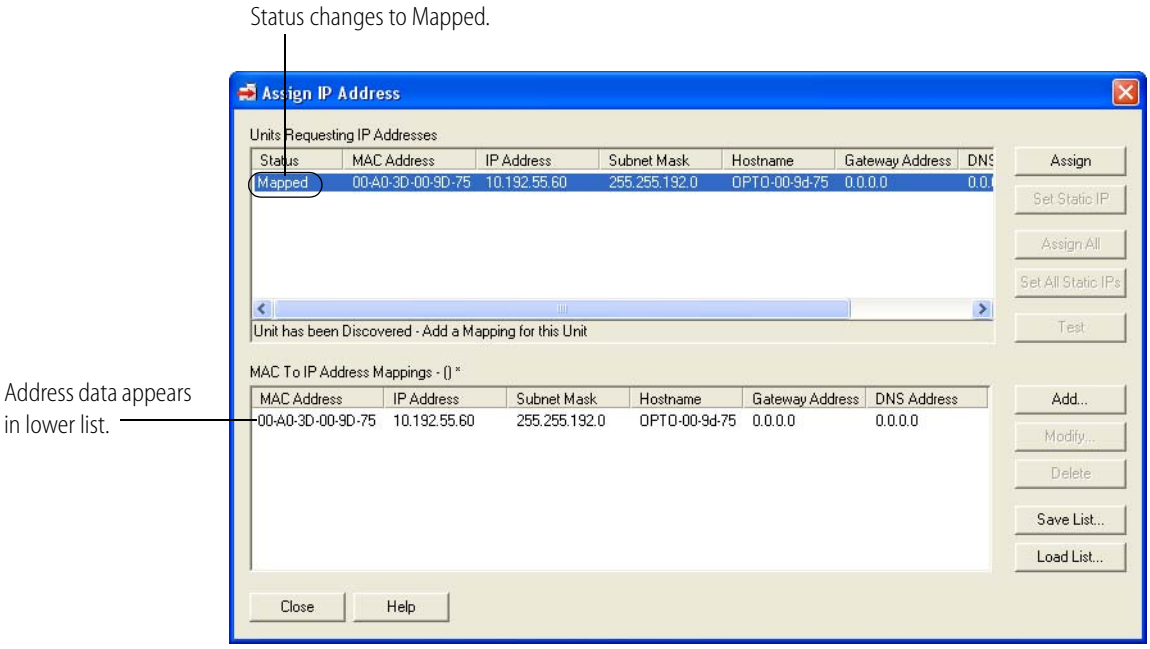


5. Enter the IP Address and the Subnet Mask for the device. If it will be talking to a device on another subnet, enter the Gateway (router) address. If it will talk only on the local subnet, leave the gateway address all zeros (0.0.0.0). Leave the DNS address at 0.0.0.0 and the Host Name field as is, since you will not be communicating with the I/O unit using its host name.

WARNING! *Each device on your network, including computers, routers, controllers, brains, and so on, must have a unique IP address. Failure to assign unique IP addresses may cause catastrophic network or hardware failures. If you don't know which IP addresses are safe to use, check with your system administrator.*

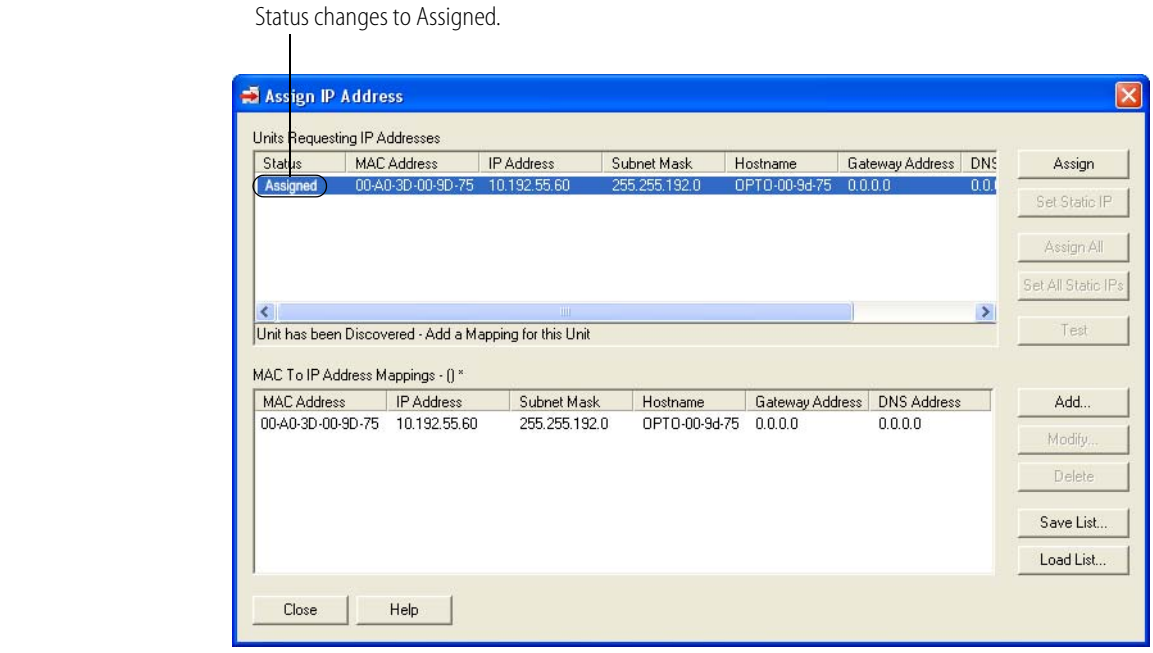
6. When the IP address, subnet mask, and other fields are correct, click OK.

The new IP address information appears in the upper list in the dialog box, and the device's status changes to Mapped. The address information also appears in the lower list to show that this device has been mapped to this address.



7. With the device still highlighted, click Assign.

The status changes to Assigned.



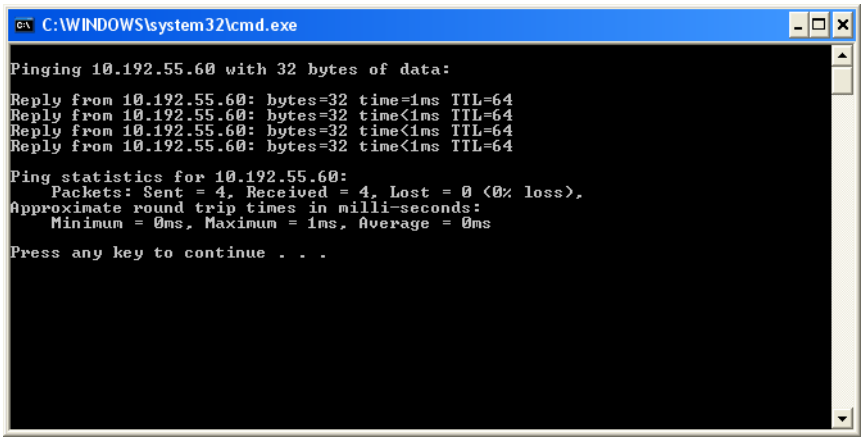
NOTE: Once a device's status becomes Assigned, you can no longer change its IP address information from this dialog box. To change the address, use Tools→Change IP Settings. (See page 195.)

8. Now click Set Static IP to make the IP address static.

The address information is saved to flash memory and the status changes to Static IP.

9. To verify that the IP address has been successfully assigned, highlight the device in the upper list and click Test.

   A DOS window opens and the IP address is automatically contacted using the PING program. You should see a reply similar to the following:


C:\WINDOWS\system32\cmd.exe
Pinging 10.192.55.60 with 32 bytes of data:
Reply from 10.192.55.60: bytes=32 time=1ms TTL=64
Reply from 10.192.55.60: bytes=32 time<1ms TTL=64
Reply from 10.192.55.60: bytes=32 time<1ms TTL=64
Reply from 10.192.55.60: bytes=32 time<1ms TTL=64
Ping statistics for 10.192.55.60:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
Press any key to continue . . .

   If you don't see a reply, make sure the subnet mask you've assigned matches the subnet mask on your PC.

10. For future reference, write the IP address in the white space on the brain board.

    The E1 or E2 brain board is now ready for use with a static IP address.

11. Repeat steps 4 through 10 for any other brain boards in the list that you are responsible for.

12. To save for future reference the list of IP address and MAC address mappings (the lower list in the dialog box), click the Save List button. Navigate to the folder where you want to save the file, enter a filename, and click Save.

    The address information is saved. You can load this information into PAC Manager later if you need to see it.

13. To configure points on E1 and E2 I/O units, see Opto 22 form #1576, *Technical Note: I/O Configuration for E1 and E2 Brain Boards*.

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

Assigning IP Addresses to Multiple Devices

If you are an OEM, integrator, or customer who has a large number of Opto 22 devices to work with at once, you may find it easier to first create a file of MAC-to-IP address mappings, and then assign IP addresses from the file. This method works for SNAP Ethernet-based controllers, brains, and brain boards.

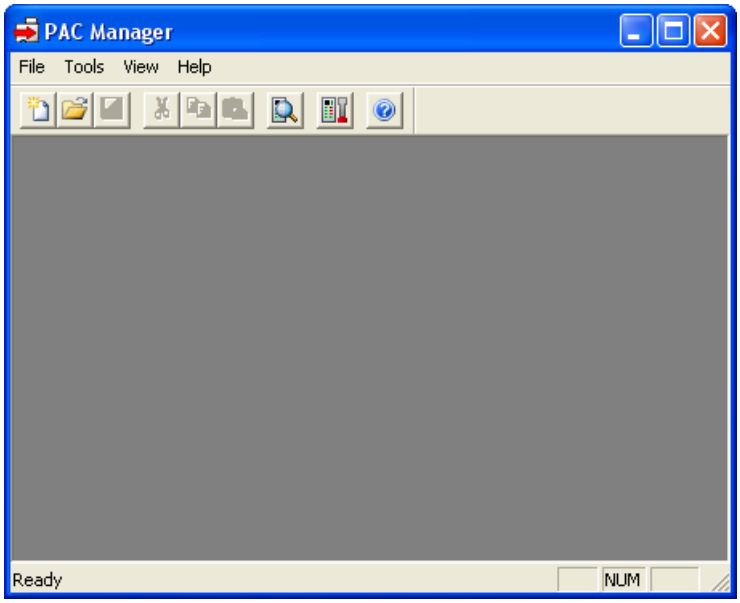
Creating the Map File

1. Make sure you have the MAC addresses for all Opto 22 devices in front of you. Also make sure you know what IP addresses and subnet masks you are going to use for them.

The MAC address for each device appears on a white sticker or space on the device itself. To determine the IP addresses and subnet masks to use, work with the network administrator for the Ethernet network on which the devices will be used.

NOTE: On a SNAP PAC controller, you can assign only the primary IP address using these steps. To assign the secondary IP address, follow steps on page 28.

2. Before installing the Opto 22 devices, open PAC Manager (Start➞Programs➞Opto 22➞PAC Project Software➞PAC Manager).

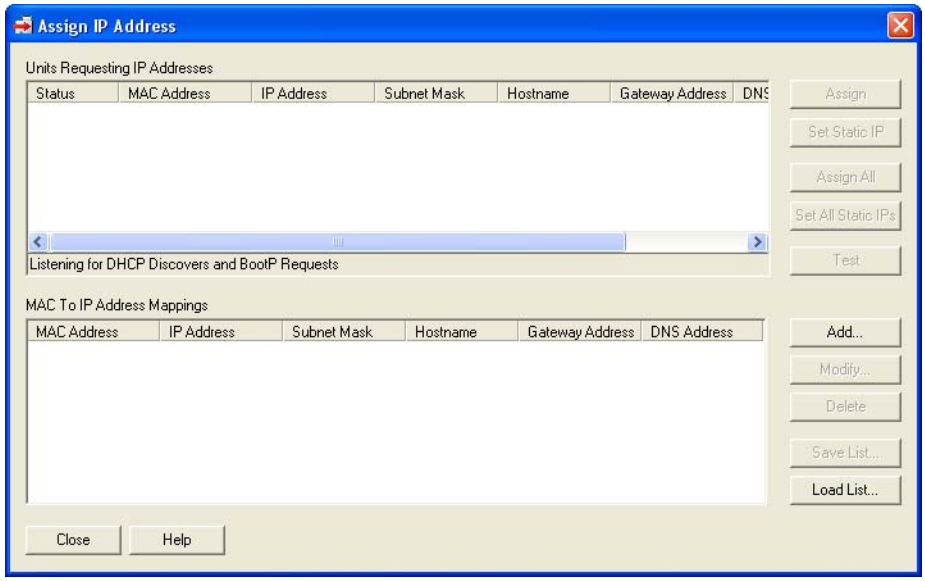


3. From the Tools menu, choose Assign IP Address.

   The Assign IP Address dialog box opens.

Upper section is used for live assignment to devices.

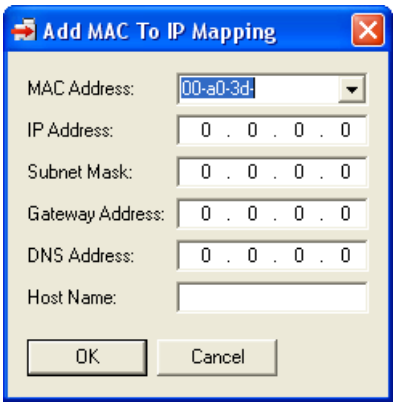
Lower section shows contents of a file containing lists of addresses. These addresses may or may not be actual assignments.



The upper section of this dialog box lists all Opto 22 devices on the same network that send a BootP or DHCP broadcast while the dialog box is open. When you are ready to assign IP addresses, this is where you do so. For now, ignore anything that appears here.

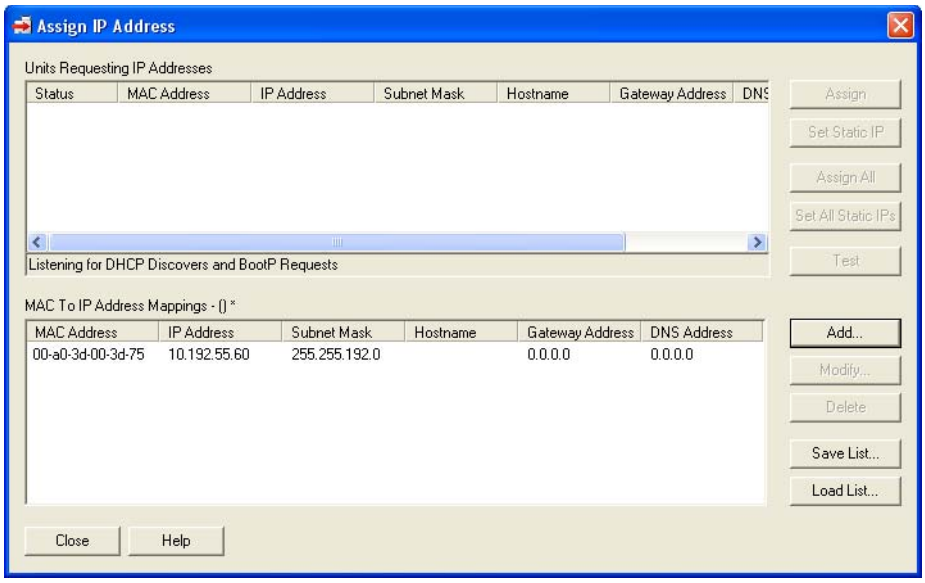
The lower section shows the contents of a mapping file you create, either while assigning actual addresses or in advance of assigning them. This file can be saved, changed, and reloaded at a later time for reference or to quickly assign addresses using the upper section—but the actual addresses on devices cannot be assigned or changed here. The important thing to remember about this lower section is that *the list does not necessarily reflect actual addresses on devices*. The IP addresses in the list may not have been assigned yet, or a device's address might have been changed at some point and the list not updated.

4. In the lower section of the dialog box, click Add.

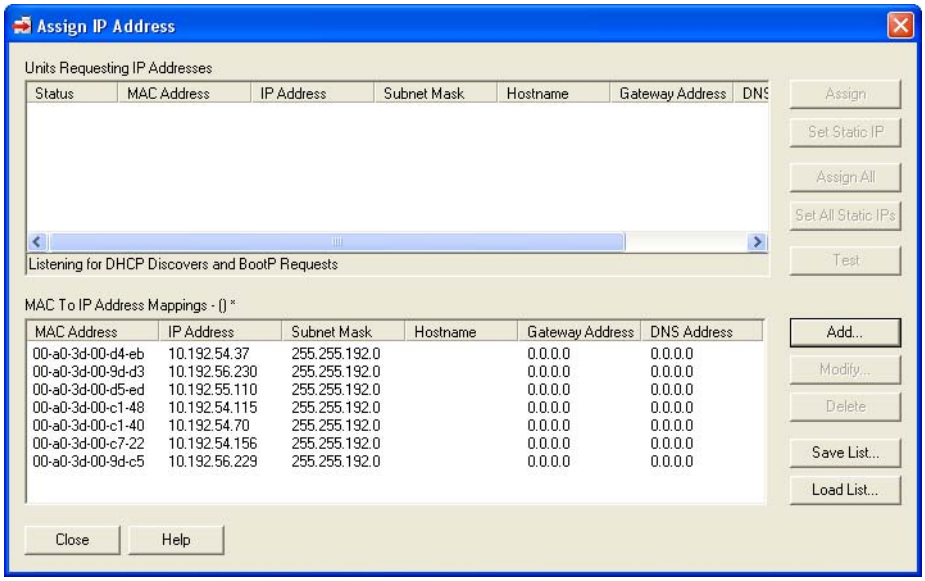


5. For the first Opto 22 device, type the correct MAC address (the first six digits are entered for you; they are the same for all Opto 22 devices). Enter the IP address and subnet mask. Enter the Gateway address if needed. Leave the DNS address at 0.0.0.0 and the Host Name field blank.
6. Double-check all numbers. When all are correct, click OK.

The device's address information is listed in the lower section of the dialog box.



7. Click Add again and add additional addresses until all of them are listed in the lower section.



8. Double-check the addresses. If one is incorrect, click it to highlight it, click Modify, and make the necessary changes.
9. To save the mapping file, click Save List. In the Save dialog box, navigate to the folder where you want to place the file, enter a filename, and click Save.

   If you later want to change the mapping (.map) file or assign IP addresses from it, you can open it in PAC Manager or Notepad.
10. Continue with the next section to assign the addresses.

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

Assigning Addresses from the Map File

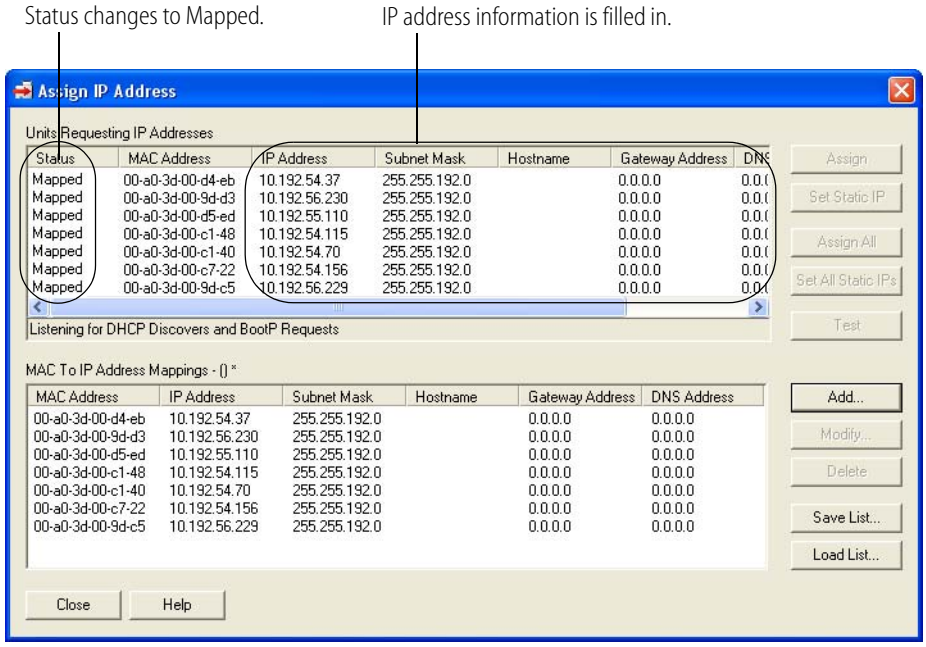
NOTE: BootP and DHCP broadcasts cannot get through a firewall in the PC where PAC Manager is running. Make sure any firewall in the computer (such as the built-in firewall in Windows XP) is disabled before you try to assign IP addresses. Firewalls in a router should not be a problem.

1. IMPORTANT: Disable all DHCP servers on the Ethernet network you are using to assign IP addresses.

   If a DHCP server is enabled on the network, it may assign IP addresses before PAC Manager has a chance to do so. If that happens, turn off power to the devices, disable all DHCP servers, and turn the devices back on. They should broadcast again.

2. Make sure that each Opto 22 device is installed according to directions in its user's guide. Make sure the PC you use is on the same network segment as the devices.
3. Turn on all the Opto 22 devices.
4. If PAC Manager is not already running, open it. Choose File→Assign IP Address.
5. If the .map file you want does not appear in the lower section of the Assign IP Address dialog box, click Load List, locate the file, and open it.

   The Opto 22 devices begin to appear in the upper section of the dialog box. IP address information from the map file is copied to the corresponding MAC address in the upper section, and the status of each device changes to Mapped.



6. Check the address information. If anything is incorrect, double-click the device in the lower list and change it. Click Save List to save the change to the file.

   The change is automatically made to the upper section.

7. When all addresses are correct, click Assign All.

- On DHCP devices, the status changes to Assigned.
- On BootP devices, the address is saved to flash memory, and the status changes to Static IP.

8. If any E1s and E2s are in the list, click Set All Static IPs to save the IP address information as static addresses.

   If you do not save the address as a static IP address, the E1s and E2s will lose their addresses as soon as power is turned off. The next time power is turned on, the brain boards will send out a DHCP broadcast again.

The devices now have their IP addresses. If you need to change an address, use Tools→Change IP Settings (see page 195). To assign a secondary IP address to a SNAP PAC controller, see the steps in the next section.

PAC-R
PAC-S

Assigning a Secondary IP Address (SNAP PAC Controller Only)

NOTE: This section does not apply to SNAP PAC brains; the two Ethernet network interfaces on a SNAP PAC brain have the same IP address.

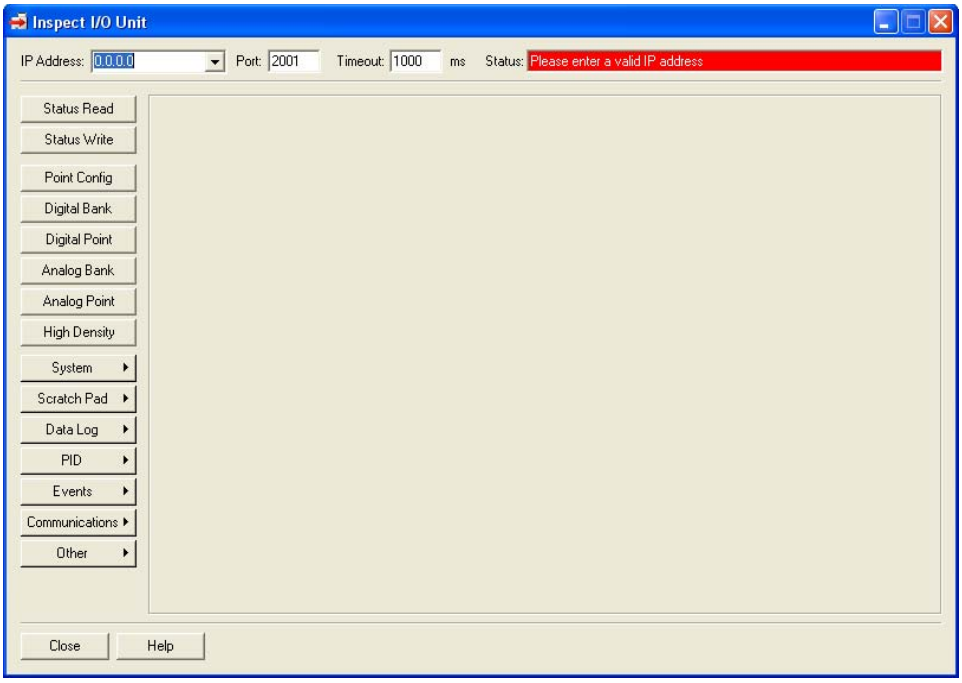
SNAP PAC R-series and S-series controllers have two independent Ethernet network interfaces, labeled on the top of the controller as ENET1 and ENET2. The controller sends its initial BootP request from ENET1, and the IP address you assign to the controller is for this primary interface. To communicate through ENET2, you must assign it a separate IP address following the steps below.

IMPORTANT: *The two Ethernet interfaces will work only if they are on separate network segments, so the control engine can clearly determine where to direct communication. For example:*

	ENET1	ENET2
IP Address:	192.168.0.12	10.0.0.5
Subnet Mask:	255.255.255.0	255.255.255.0

1. If PAC Manager is not already open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

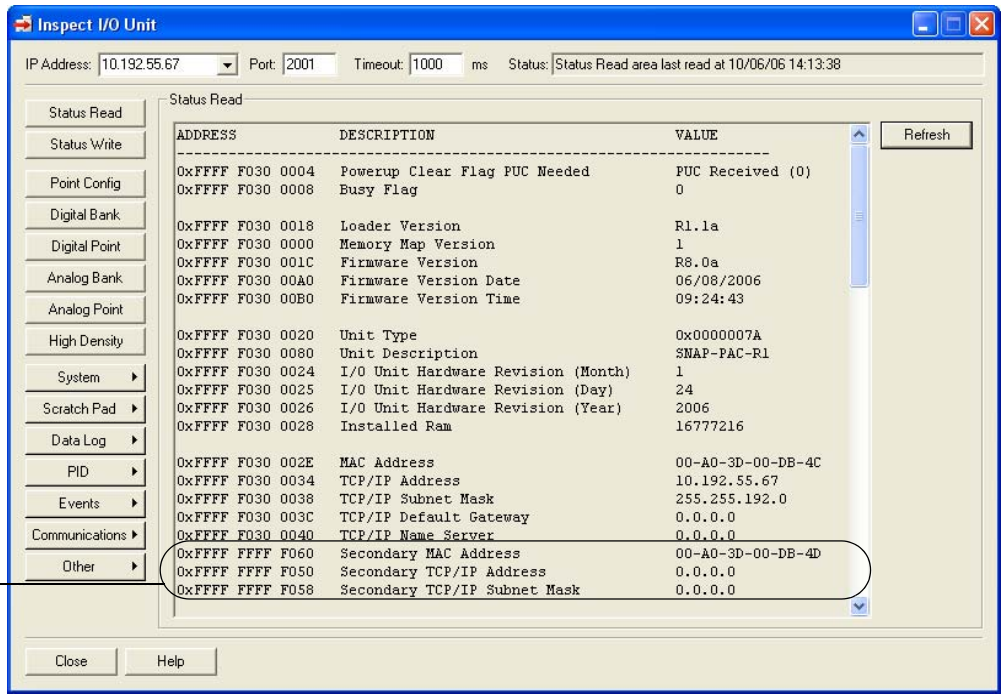
2. In the PAC Manager main window, click the Inspect button .



If this is the first time you have used the Inspect button, the IP address will show 0.0.0.0, as shown above. If you have used the Inspect button before, the last IP address you used is shown, and the most recently used IP addresses are available in the drop-down list.

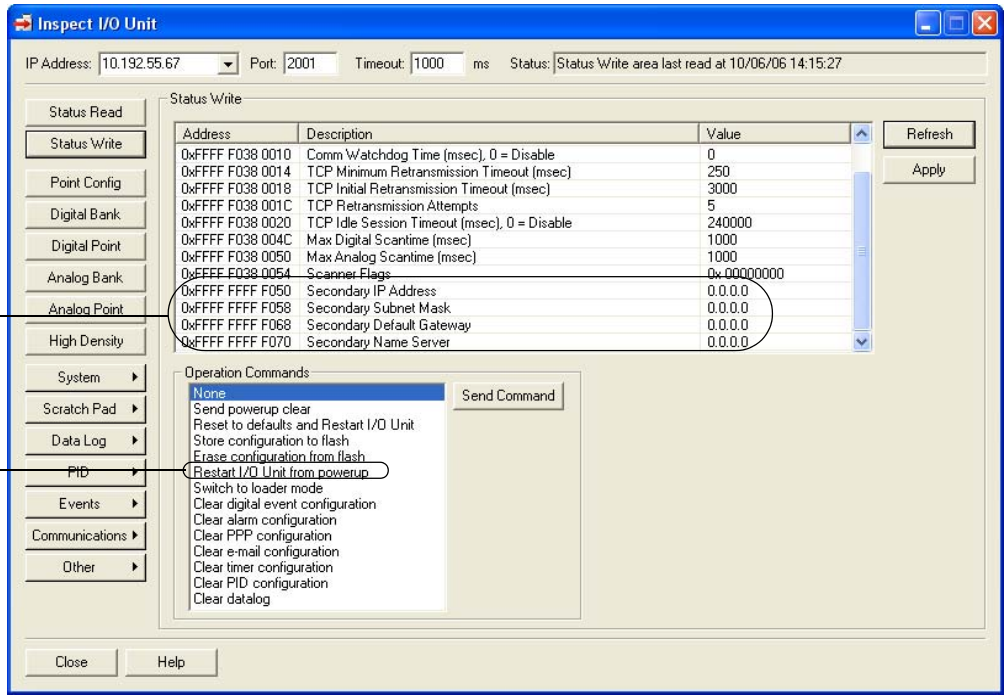
3. In the IP Address field, type the IP address for ENET1 (the primary IP address) on the SNAP PAC controller (or choose it from the drop-down list). Click Status Read.

Status information for the controller is shown in the window. If the secondary IP address has not been assigned yet, the secondary IP address information will show all zeros:


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 10/06/06 14:13:38
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 06/08/2006
0xFFFF F030 00B0 Firmware Version Time 09:24:43
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 0.0.0.0
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 0.0.0.0
Close
Help

Secondary IP address information (scroll down to see all entries).

4. Click Status Write. Scroll down to see all the secondary IP address fields.



Secondary IP address fields

Restart command

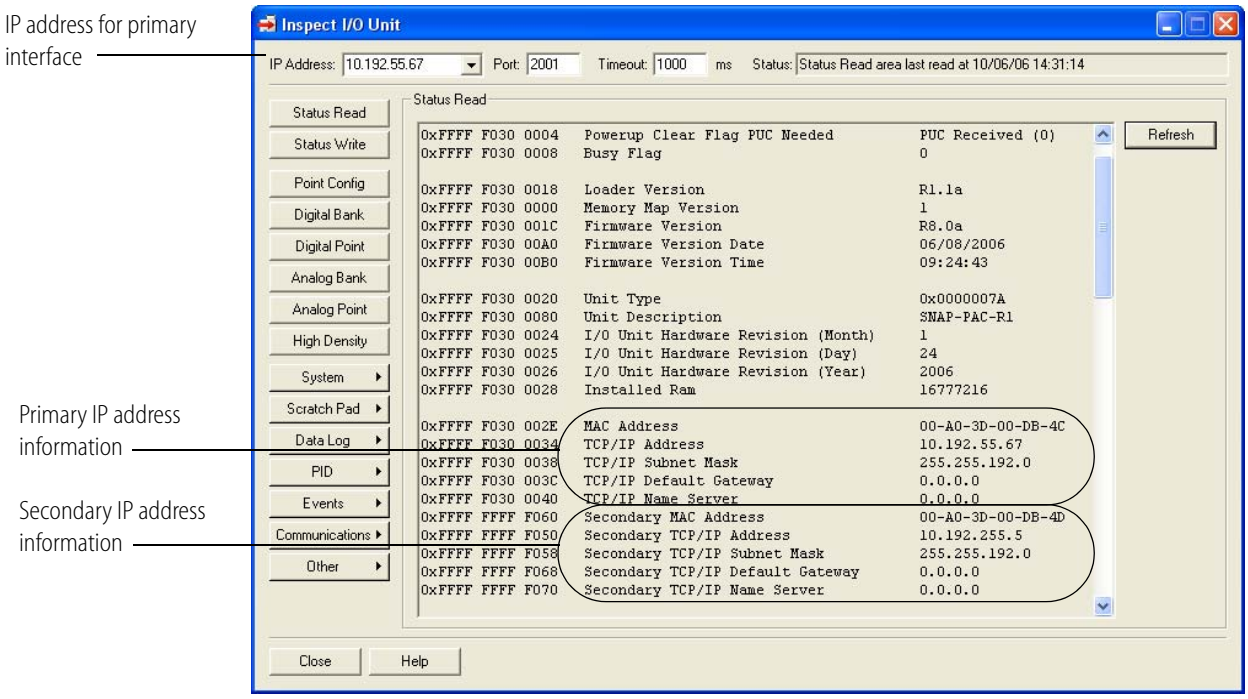
5. Click the Value field for Secondary IP address and type in the IP address for ENET2. Enter the Secondary Subnet Mask the same way. If necessary, change the Gateway. Leave the Name Server as is.
6. When all the secondary IP address fields are correct, click Apply.

The information is sent to the SNAP PAC, but it cannot communicate on the secondary interface until it is restarted.

7. In the Operation Commands section, highlight Restart I/O Unit from powerup. Then click Send Command.

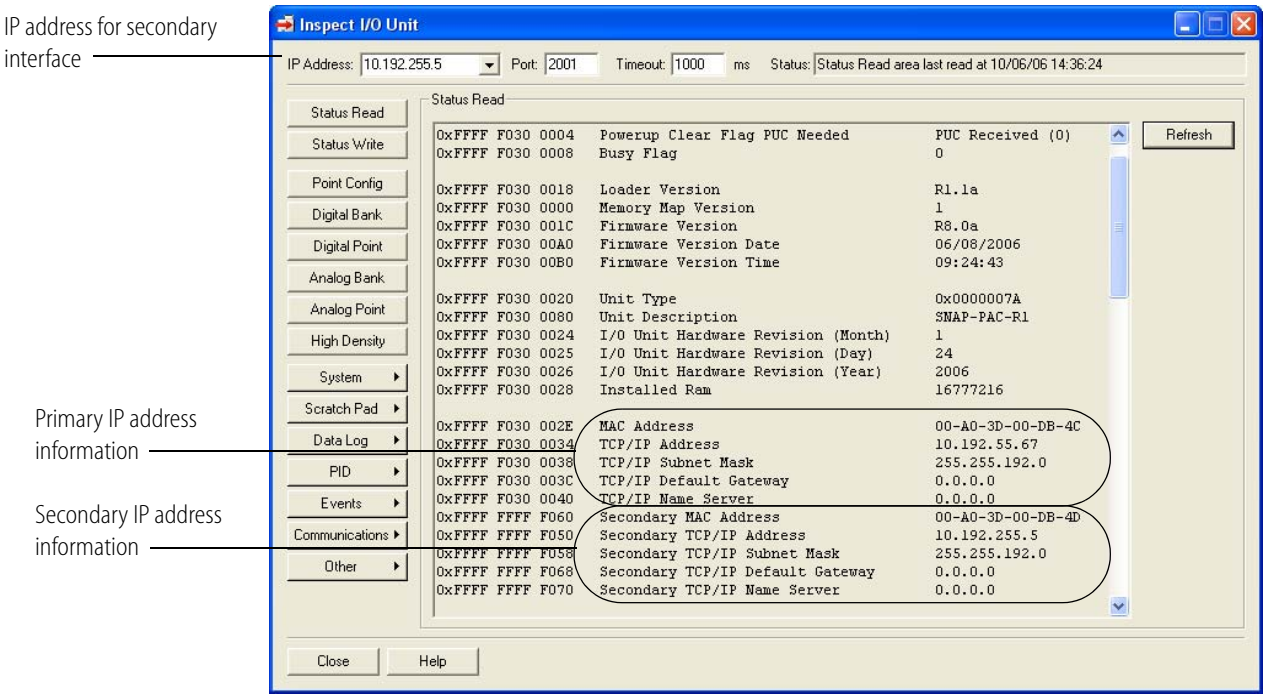
The SNAP PAC is restarted.

8. Check to make sure the controller is back on line by clicking Status Read again. Click OK at the message. Scroll down a little to see all the secondary IP address information.


IP address for primary interface
Primary IP address information
Secondary IP address information
Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000
ms
Status: Status Read area last read at 10/06/06 14:31:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Refresh
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 06/08/2006
0xFFFF F030 00B0 Firmware Version Time 09:24:43
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
0xFFFF FFFF F068 Secondary TCP/IP Default Gateway 0.0.0.0
0xFFFF FFFF F070 Secondary TCP/IP Name Server 0.0.0.0
Close
Help

9. To verify that the secondary IP address is also communicating, make sure ENET2 is attached to the correct network. On a PC on the same subnet as ENET2, open the PAC Manager Inspect window. Enter the secondary IP address in the IP Address field and click Status Read.

The controller now shows the same information, but through the secondary interface:


IP address for secondary interface
Primary IP address information
Secondary IP address information
Inspect I/O Unit
IP Address: 10.192.255.5
Port: 2001
Timeout: 1000
ms
Status: Status Read area last read at 10/06/06 14:36:24
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Refresh
Close
Help
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 06/08/2006
0xFFFF F030 00B0 Firmware Version Time 09:24:43
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
0xFFFF FFFF F068 Secondary TCP/IP Default Gateway 0.0.0.0
0xFFFF FFFF F070 Secondary TCP/IP Name Server 0.0.0.0

Creating an I/O Unit Configuration File

NOTE: For E1 and E2 I/O units, if you are communicating with them using Optomux only, you do not need to configure them in PAC Manager. However, if you are also communicating with E1 and E2 I/O units using OptoMMP, Modbus/TCP, or PAC Project software (including OptoOPCServer and OptoDataLink), you must configure them.

To configure E1 and E2 I/O units, do not use the steps in this section; instead, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

NOTE: This section applies only to Ethernet-based I/O units, not to serial mistic I/O units. Mistic I/O units must be configured in PAC Control.

PAC-R EB UIO EIO SIO

Before you create a control strategy using PAC Control, or before you read or write to I/O units, you need to configure the I/O points and features the strategy or other application will use. You can use PAC Manager to copy a configuration or to configure all points, save the configuration to a file, and then upload the configuration to one I/O unit or to several at once. You do not need to be attached to the I/O unit while you are creating the configuration file and configuring its points.

NOTE: If you are using OPC to communicate with the I/O unit, you can use the configuration file (tag file) that PAC Manager produces as an easy way to reference points for OPC. See Opto 22 form #1439, the OptoOPC Server User's Guide, *for more information about using OPC.*

You can start configuration in one of three ways:

- If this is a new configuration, you can create a new configuration file (page 33).

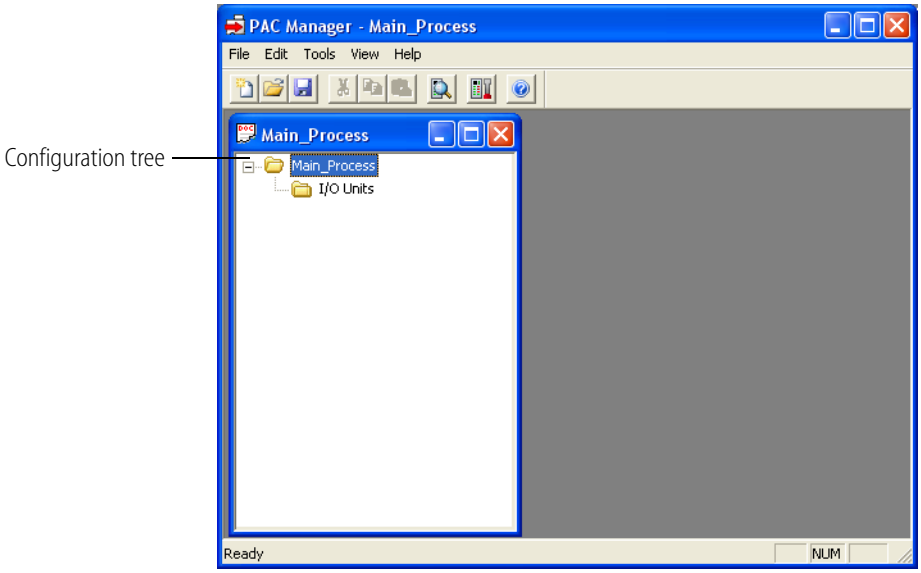
- If an existing I/O unit has the exact configuration you want, you can copy it directly to another I/O unit (page 34).
- If you have a PAC Control (or OptoControl or ioControl) strategy with similar I/O units configured, you can save them as a configuration file (page 35) and modify the configuration. Note that this method transfers I/O unit and point information only; any event messages, email or SNMP settings, and so on are not included when a configuration file is exported from or imported to OptoControl, ioControl, or PAC Control. Also, 4-channel digital module and point information is generic; you will need to reenter specific digital configurations.

PAC-R
EB
UIO
EIO
SIO

Creating a New Configuration File

1. If PAC Manager is not already open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the New button or choose File→New.
3. In the Create New Tag Database dialog box, navigate to the location where you want the file to be. Type a filename. Click Open.

   A new configuration tree appears. (If you are familiar with PAC Control, ioControl, or OptoControl, you'll notice that this window looks like part of a Strategy Tree.)



   You can expand and collapse the folders to see or hide the I/O units and points in them. Closing the configuration tree is the same as closing the configuration file.

4. To save the configuration file, click the Save button or choose File→Save.
5. Once the file is saved, continue with "Adding an I/O Unit" on page 36.

PAC-R
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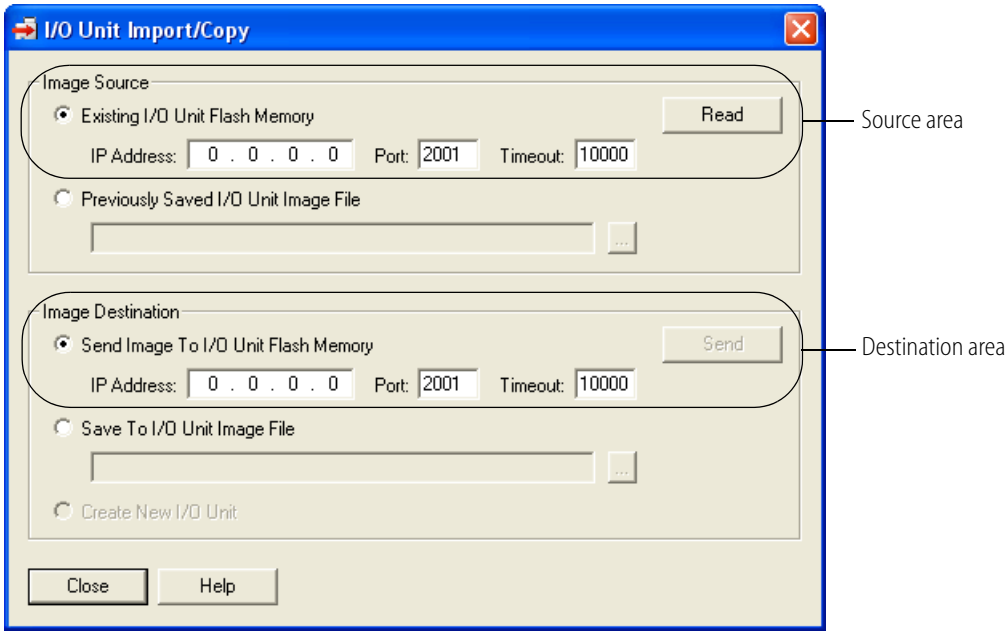
UIO
EIO
SIO

Copying a Configuration to Another I/O Unit

If you have an Ethernet-based I/O unit that is exactly the configuration you want, you can copy it directly to the flash memory of an I/O unit. This method does not create a configuration file, but simply copies from one unit to another.

1. If PAC Manager is not already open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, choose Tools→Import/Copy I/O Unit.



3. In the Source area of the dialog box, choose an existing I/O unit. Enter its IP address and port. (Use the default of 2001 unless you have changed the port.) If necessary, change the timeout.
4. When the source is correct, click Read.

   The source is read, and you see a confirmation box.
5. In the Destination area of the dialog box, choose Send Image To I/O Unit Flash Memory. Enter the IP address and port of the I/O unit you want to copy the configuration to. (Use the default of 2001 unless you have changed the port.) Change the timeout if necessary.

   CAUTION: *Make sure you have entered the correct IP address. The configuration will overwrite anything currently in the I/O unit's flash memory.*
6. When the destination is correct, click Send.

   The configuration is sent directly to the I/O unit's flash memory, and you see a confirmation box.

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UIO
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SIO

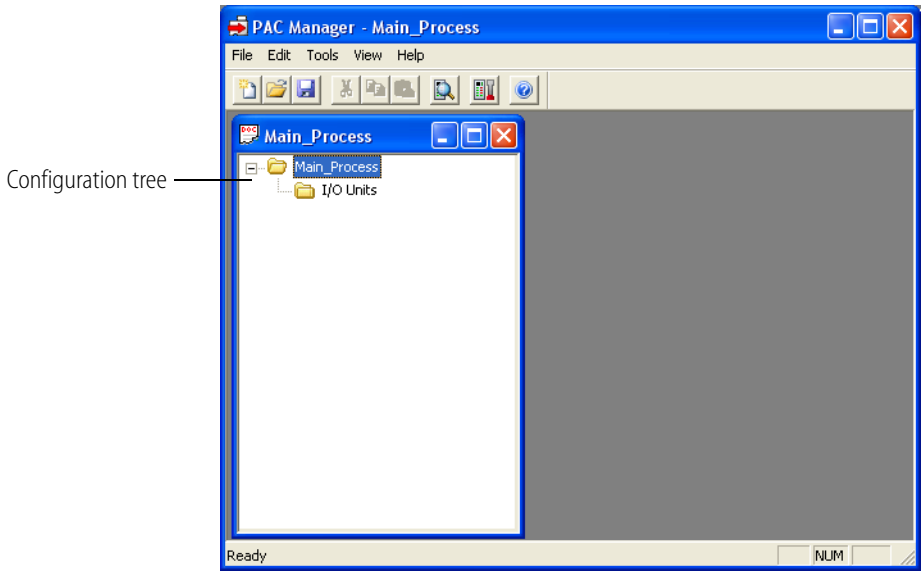
Creating a Configuration File from Another Strategy

If you use PAC Control, ioControl, or OptoControl and have a strategy with SNAP Ethernet-based I/O units already configured, you may want to export that file and use it as a starting point, rather than creating a configuration file from scratch. The exported file will contain all the I/O units in the strategy. However, note the following:

- I/O unit and point data is transferred; optional functions such as event messages are not.
- Four-channel digital modules and points do not retain specific configurations but revert to generic ones. Specific data will have to be reentered.
- You cannot save changes you make in PAC Manager back to the strategy file. Instead, you save them to a configuration file, which can then be imported into PAC Control or OptoControl.
- Any serial I/O units in the PAC Control, ioControl, or OptoControl strategy file are filtered out in PAC Manager and are no longer included in the configuration file.

Follow these steps to create a configuration file from an existing strategy:

1. In PAC Control, ioControl, or OptoControl, open the strategy that contains the I/O units whose configurations you want to export.
2. In the configuration tree, right-click the I/O Units folder and choose Export from the pop-up menu.
3. In the Export I/O Units to an Opto Tag Database dialog box, navigate to the location where you want to save the configuration file. Enter a name for the file, and click Save.
4. If PAC Manager is not already open, choose Start➞Programs➞Opto 22➞PAC Project Software➞PAC Manager.
5. In the PAC Manager main window, click the Open button or choose File➞Open.
6. In the Open Tag Database dialog box, locate the file you just saved and open it.



7. Expand the I/O units folder in the configuration tree to see the units and points that are already configured.
8. Continue with the next section to add or change I/O units.

Adding an I/O Unit

PAC-R
EB
UIO
EIO
SIO

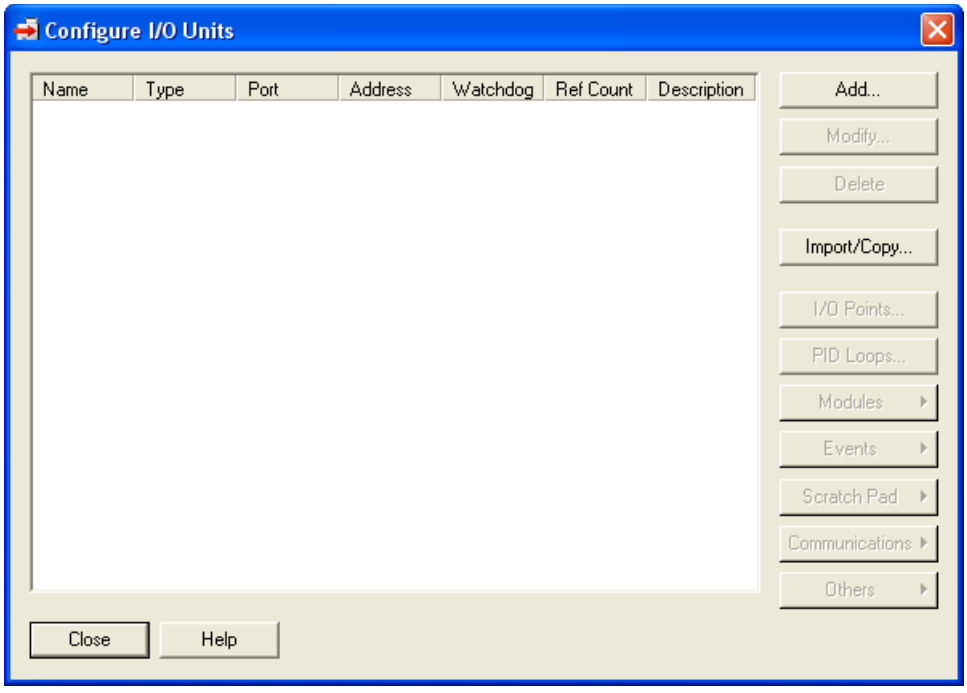
NOTE: To configure E1 and E2 I/O units, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

Mistic serial I/O units used with a SNAP PAC S-series controller must be configured in PAC Control.

An I/O unit consists of a SNAP I/O mounting rack, plus the I/O processor (brain or on-the-rack controller) and I/O modules mounted on it. Racks used with SNAP Ethernet-based I/O units can hold up to 16 modules. Depending on the I/O processor model and type of rack, the rack may include only 4-channel digital modules or all types of modules: analog and digital modules with any number of points, plus serial modules.

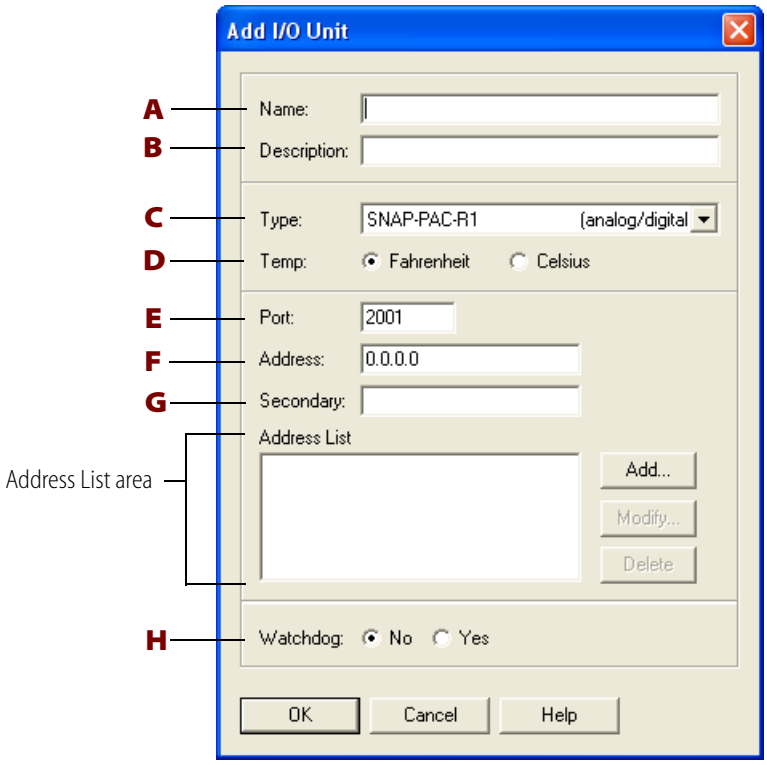
You must add an I/O unit before you can configure its modules and points.

1. Make sure the configuration file is open. On the configuration tree, double-click the I/O Units folder to open the Configure I/O Units dialog box:



2. To configure a new I/O unit, click Add or double-click anywhere in the box below any listed units.

   The Add I/O Unit dialog box appears:



3. Complete the fields as follows:
   - **A** Enter a name for the I/O unit. The name must start with a letter and may contain letters, numbers, and underscores. Spaces are converted to underscores.
   - **B** (Optional) Enter a description of the unit.
   - **C** Select the type of I/O unit from the drop-down list.
   - **D** Choose whether temperatures will be handled in Fahrenheit or Celsius.
   - **E** Specify the communication port to use (2001, unless you have changed it for security purposes according to instructions starting on page 76).
   - **F** Enter the IP address for the I/O unit.
   - **G** If it's a SNAP PAC R-series I/O unit with a secondary IP address, enter the secondary IP address.
   - **H** Select whether you want a Watchdog on the unit. The default is No (disabled). If you select Yes, a new field appears; enter the Watchdog timeout value in seconds. The default timeout is 0.5 seconds. For information on watchdogs, see page 72.

   The *Address List area* shows IP addresses of the I/O units that should receive this configuration. If this is the only I/O unit to receive the configuration, don't add any addresses here. However, if you have I/O units that are exactly alike, list all of them here. That way you can download the configuration file to all the I/O units at once.

   a. To add an IP address, click Add.

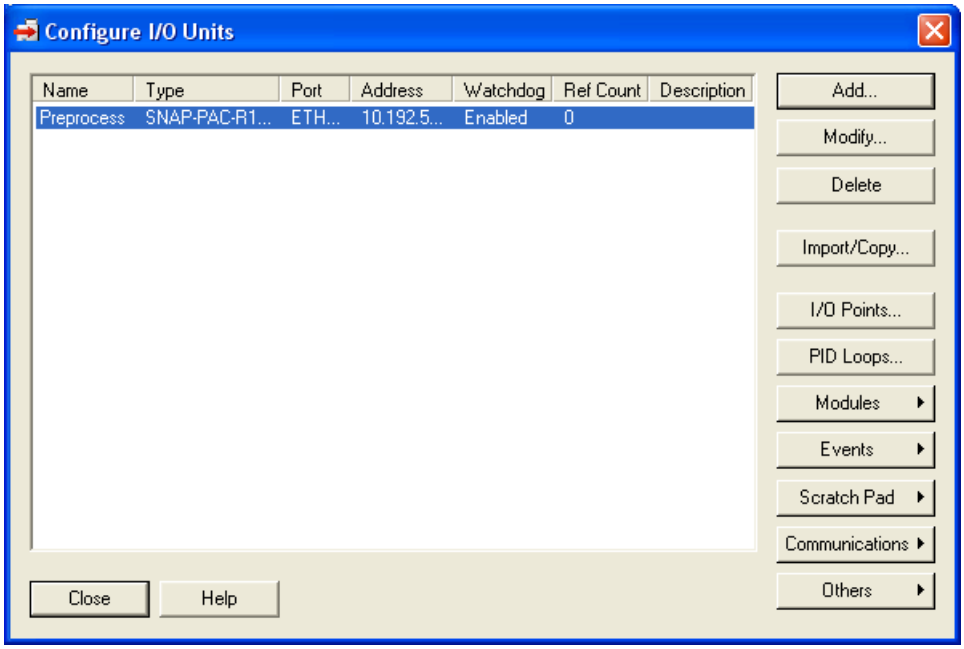
In the dialog box, you can add a single IP address or a range of addresses:

b. Enter the IP address(es) and click OK.

The addresses appear in the Address List area.

4. When information in the Add I/O Unit dialog box is complete, click OK.

The new I/O unit appears in the Configure I/O Units dialog box:



5. Continue with the next section, "Configuring I/O Modules and Points."

Configuring I/O Modules and Points

PAC-R
EB
UIO
EIO
SIO

NOTE: To configure E1 and E2 I/O units, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

I/O points on mistic serial I/O units must be configured in PAC Control.

Once you have added an I/O unit, you can configure its modules and points. See the following pages for configuration steps:

Digital points	page 39
Analog points	page 42
Serial modules	page 48
Profibus modules	page 53
Wiegand modules	page 55
PID modules	page 57

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Configuring SNAP Digital Points

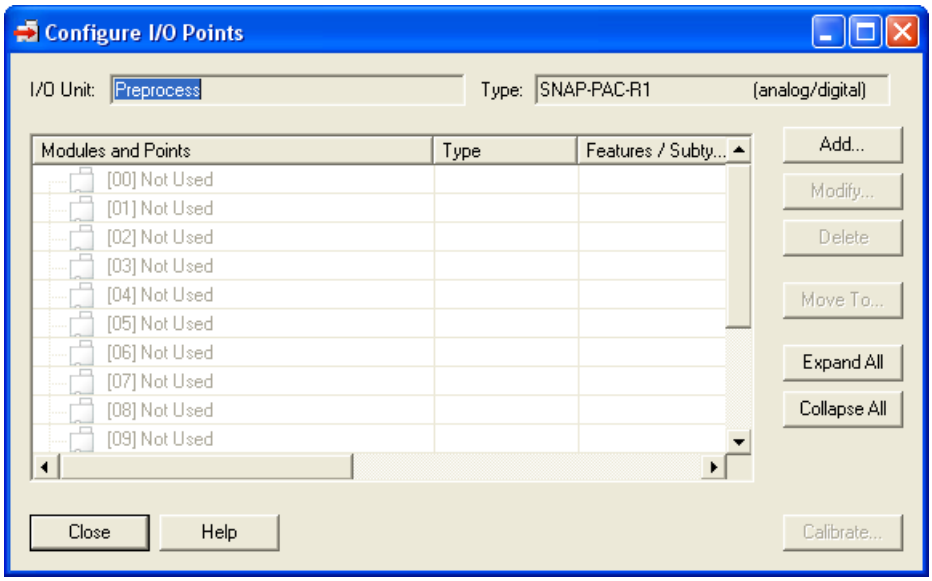
NOTE: To configure E1 and E2 I/O units, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

I/O points on mistic serial I/O units must be configured in PAC Control.

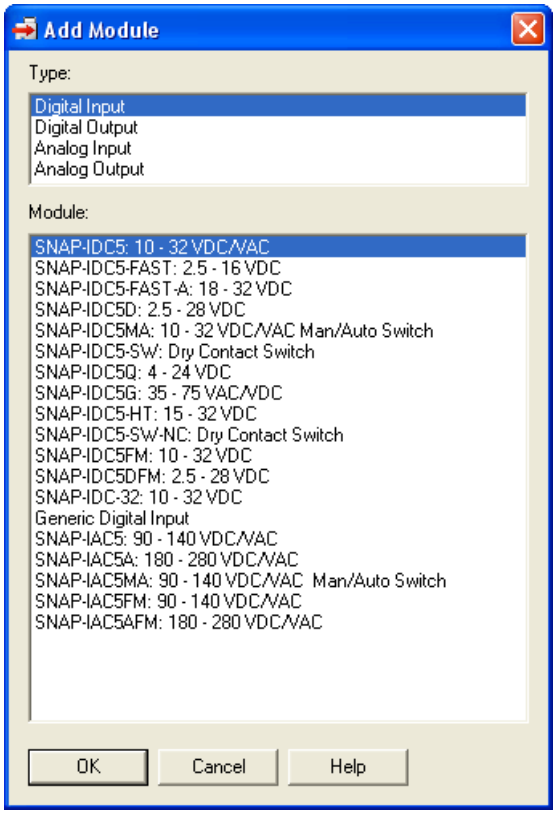
Use the following steps to configure digital points on all 4-channel and high-density SNAP digital modules supported by the brain or on-the-rack controller.

1. In the Configure I/O Units dialog box, make sure the I/O unit for the point you are adding is highlighted. Click the I/O Points button.

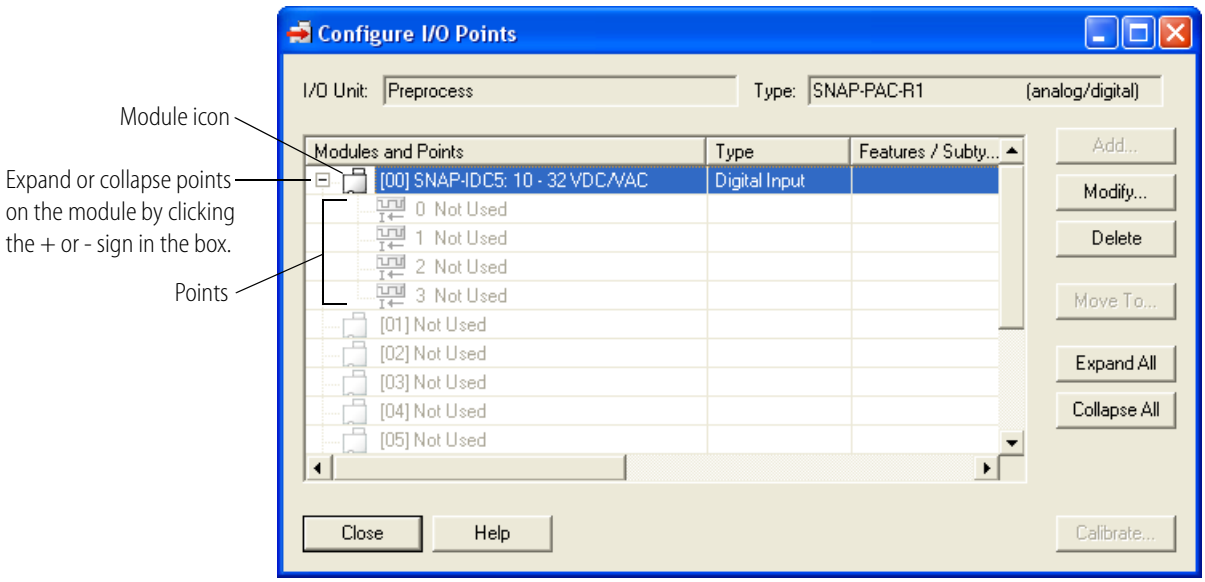
The Configure I/O Points dialog box appears:



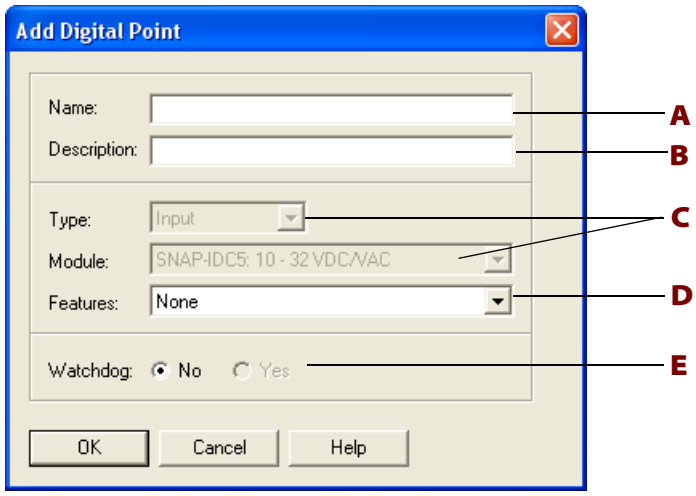
2. Double-click the number that represents the digital module's position on the rack. (For help, see the diagrams starting on page 153.)



3. In the Add Module dialog box, choose the module type and then the exact module part number from the lists. Click OK.
4. Back in the Configure I/O Points dialog box, click the plus sign next to the new module to expand it. Notice that the module icon is color-coded to reflect the type of module being configured: white for digital DC input, red for digital DC output, yellow for digital AC input, and black for digital AC output.



5. Double-click the point you want to configure.



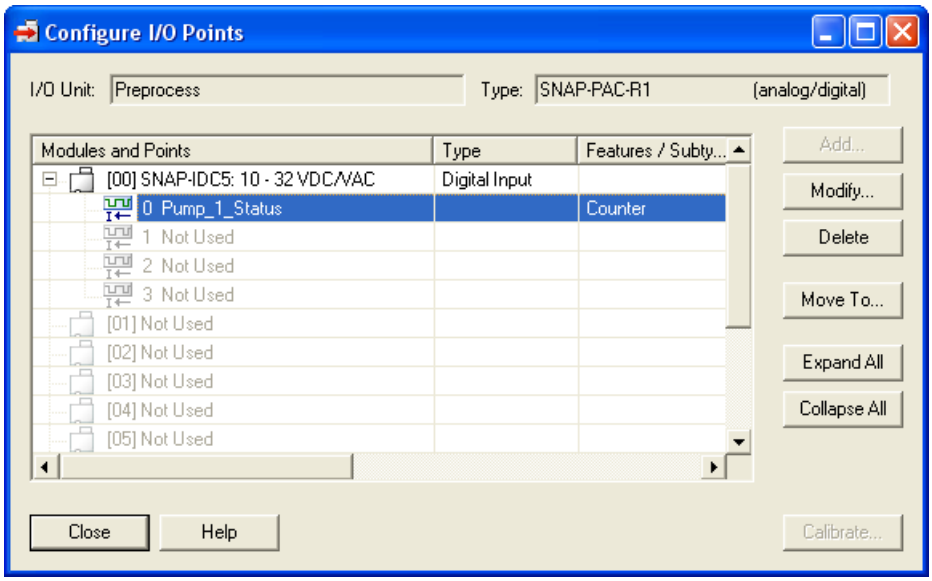
6. Complete the fields as follows:
   - **A** Enter a name for the point. The name must start with a letter and may contain letters, numbers, and underscores. Spaces are converted to underscores.
   - **B** (Optional) Enter a description of the point.
   - **C** Type and module are already filled in for you.

D To use a feature of the module, choose it from the drop-down list. (See "Using I/O Point Features" on page 68 for explanations of point features.)

E (Output modules only) To configure a status the point should be set to if the Watchdog timer on this I/O unit expires, click Yes and choose On or Off from the drop-down list.

7. When you have completed the fields, click OK.

The new point appears in the list:



8. To configure more digital points, repeat the steps. To configure analog points, see the next section.

PAC-R EB UIO EIO SIO

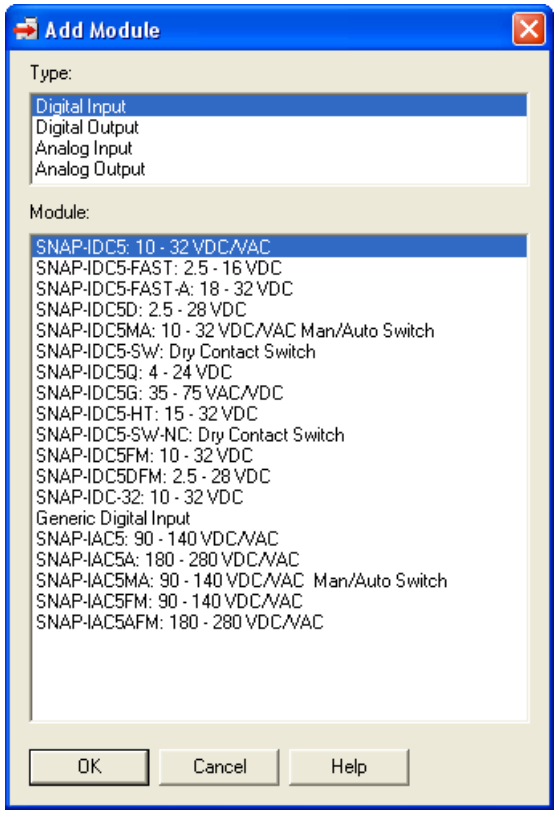
Configuring Analog Points

NOTE: To configure E1 and E2 I/O units, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

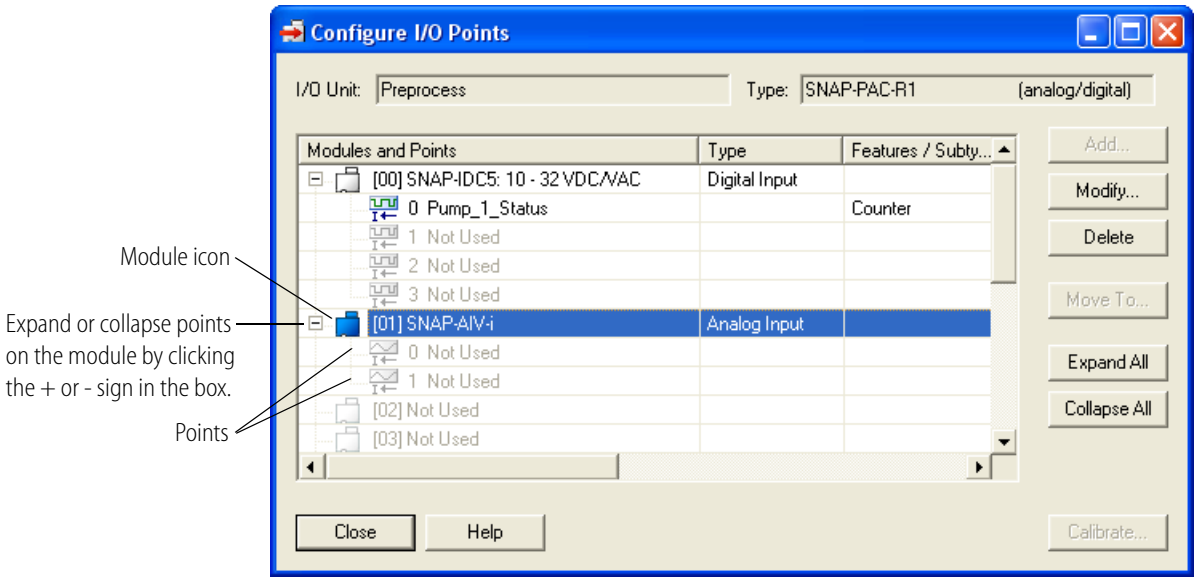
I/O points on mistic serial I/O units must be configured in PAC Control.

Use the following steps to configure analog points on all SNAP analog modules supported by the brain or on-the-rack controller.

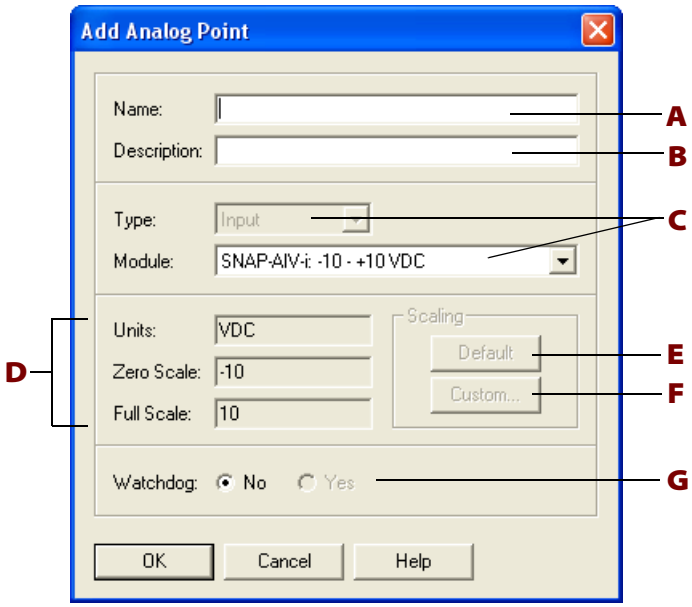
1. In the Configure I/O Points dialog box, double-click the number that represents the analog module's position on the rack. (For help, see the diagrams starting on page 153.)



2. In the Add Module dialog box, choose Analog Input or Analog Output, and then choose the exact module part number from the list. Click OK.
3. In the Configure I/O Points dialog box, click the plus sign next to the new module to expand it. Notice that the module icon is color-coded to reflect the type of module being configured: blue for analog input, green for analog output.



4. Double-click the point you want to configure.



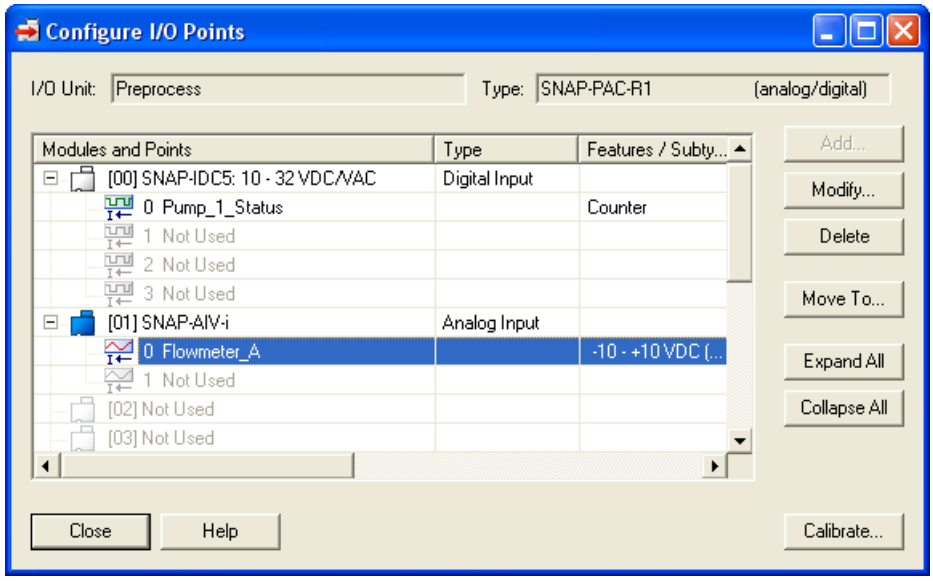
5. Complete the fields as follows:
   - **A** Enter a name for the point. The name must start with a letter and may contain letters, numbers, and underscores. (Spaces are converted to underscores.)
   - **B** (Optional) Enter a description of the point.
   - **C** Type and module are inserted for you. You may be able to choose a different range or a scalable module from the drop-down list.
   - **D** Units and scaling for this module. See "Using Custom Scaling" on page 45.
   - **E** (Scalable modules only.) To return the units, zero-scale value, and full-scale value to the defaults for the module, click Default.

F (Scalable modules only.) To assign custom units and values to the module, click Custom. For example, you could scale the voltage range of a -10 to +10 VDC module to be interpreted as engineering units of liters per second instead of volts. See "Using Custom Scaling" on page 45.

G (Outputs only.) To configure a value this point should be set to if the Watchdog timer on this I/O unit expires, click Yes and enter the value.

6. When you have completed the fields, click OK.

The new point is added:



Point types and features are shown in the Features/Subtype column.

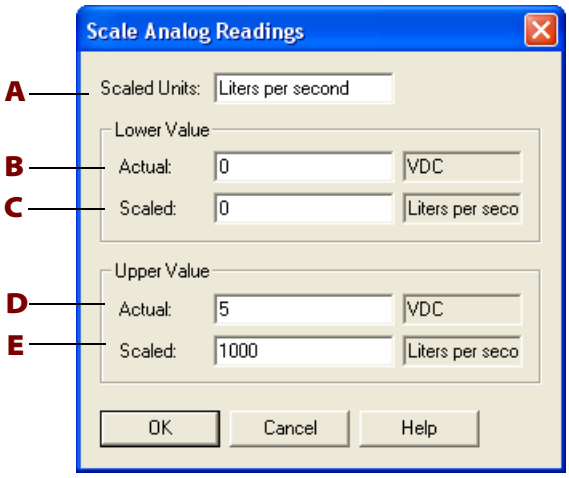
7. To add more analog points, repeat the steps. To add digital points, see page 39.

Using Custom Scaling

Scalable analog modules can be set to show something other than the actual inputs or outputs. For example, you could scale the readings of a -10 to +10 VDC input point to measure its input as zero liters per second when the real-world reading is zero VDC, and 1000 liters per second when the real-world reading is five VDC.

NOTE: Custom scaling has no effect on the resolution or accuracy of the module.

1. In the Add Analog Point dialog box, click the Custom button in the Scaling area to open the Scale Analog Readings dialog box.

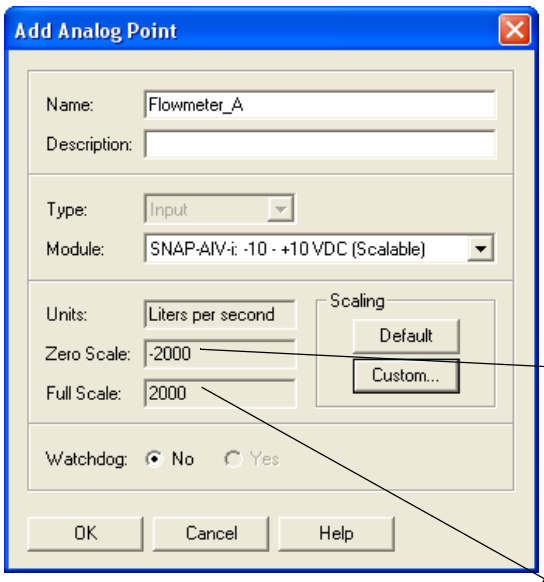


2. Complete the fields as follows:

- **A** Enter new engineering units for the module. The example uses liters per second.
- **B** Enter the actual real-world lower value that the scaled lower value corresponds to. Note that inputs typically have under-range capability, which means you can specify a lower actual value that is less than the zero-scale value. Outputs do not have under-range capability.
- **C** Enter the new scaled lower value. This value can be any floating point value.
- **D** Enter the actual real-world upper value that the scaled upper value corresponds to. For inputs, you can specify an upper actual value greater than the full-scale value.
- **E** Enter the new scaled upper value. This value can be any floating point value greater than the scaled lower value. This example uses 1000, which scales the output to 1000 liters per second when its actual reading is 5 VDC.

3. Click OK.

The new custom-scaled units appear in the Add Analog Point dialog box:



Notice the new units of liters per second and the new zero-scale and full-scale values of -2000 and +2000. The example connects a sensor with a range of 0–1000 liters per second, but an output of only 0–5 volts, to a SNAP-AIV module with an output of -10 to +10 volts. The figures in this dialog box reflect the total possible range of the module, not the sensor.

	Custom scale (Liters/sec)		Module's scale (VDC)
Possible low value for module	–2000		–10
	–1000		–5
Upper & lower values entered in dialog box	0	=	0
	1000	=	5
Possible high value for module	2000		10

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Calibrating Offset and Gain

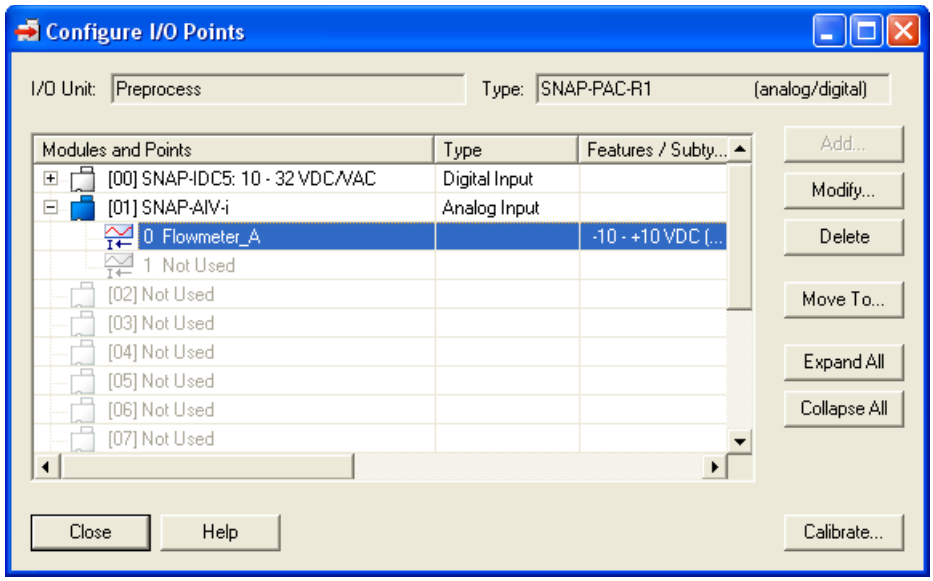
The SNAP Ethernet-based I/O unit can calibrate analog input points. If a -50 mV to +50 mV input receives signals that are slightly off (not exactly -50 mV at the lowest point, for example), the offset and gain can be calculated so that values will appear accurately when read.

Offset and gain values affect engineering units. For a temperature input, engineering units are in degrees C or F, depending on how the I/O unit is configured. You can manually set offset and gain or have them automatically calculated and set for you.

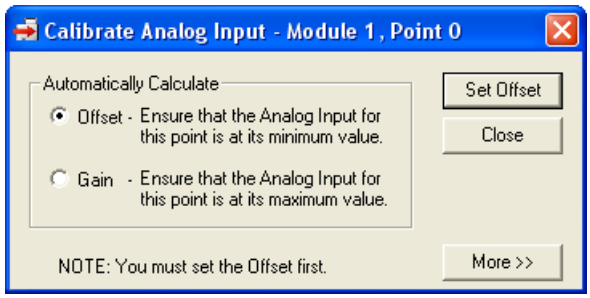
IMPORTANT: *To calibrate the point, the I/O unit must be turned on and attached to the network, and you must have access to it to use the calibrator. Save the configuration to flash so that it will not be lost when power is turned off. Since each calibration is for a specific point on a specific I/O unit, the result cannot be saved to the configuration file and cannot be sent to any other I/O unit.*

Calculate offset first, and then calculate gain. The offset must be calculated at the point's low scale, and the gain must be calculated at the point's high scale.

1. In the Configure I/O Points dialog box, highlight the analog input point you want to calibrate.



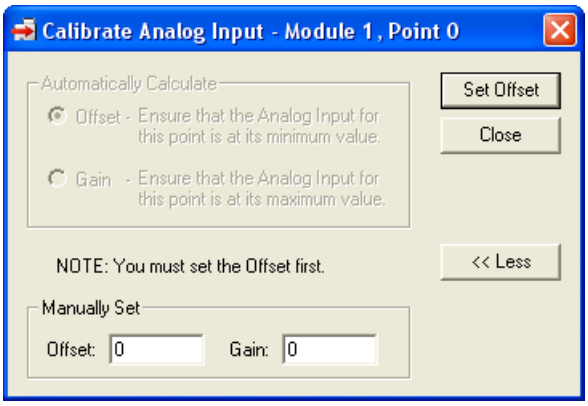
2. Click the Calibrate button in the lower-right corner of the dialog box.


Calibrate Analog Input - Module 1 , Point 0
Automatically Calculate
Offset - Ensure that the Analog Input for this point is at its minimum value.
Gain - Ensure that the Analog Input for this point is at its maximum value.
Set Offset
Close
NOTE: You must set the Offset first.
More >>

3. To have the offset and gain calculated for you, do the following:
   a. Use a calibrator to input minimum scale on the analog input point (for example, 0 degrees F or C for a temperature input). Click Offset, then click the Set Offset button.

   NOTE: On a bipolar module (for example, -10 VDC to +10 VDC), the minimum scale is always zero, not a negative number.

   b. Use the calibrator to input maximum scale on the analog input. Click Gain, then click the Set Gain button.
4. To manually set offset and gain, do the following:
   a. Click the More button.


Calibrate Analog Input - Module 1, Point 0
Automatically Calculate
Offset - Ensure that the Analog Input for this point is at its minimum value.
Gain - Ensure that the Analog Input for this point is at its maximum value.
Set Offset
Close
NOTE: You must set the Offset first.
<< Less
Manually Set
Offset: 0
Gain: 0

   b. Enter the Offset value. Click the Set Offset button.
   c. Enter the Gain value. Click the Set Gain button.
5. When you have finished calibrating the point, close the dialog box to return to configuring I/O points.

   NOTE: To store offset and gain values permanently, you must save the change to flash when you send the configuration data to the I/O unit (see page 67).

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Configuring Serial Communication Modules

Serial communication modules do not require configuration unless you need to change communication parameters such as port numbers or baud rates. Because serial modules require no configuration, they do not appear in the Configure I/O Points dialog box in PAC Manager; you have to remember which positions on the I/O unit are filled with serial modules. For more information on serial modules, see form #1191, the *SNAP Serial Communication Module User's Guide*.

NOTE: For information on connecting a Windows serial application to a remote serial device through a SNAP Ethernet-based system, see the SNAP Serial Communication Module User's Guide.

Default port numbers are shown on page 155. Default communication parameters are:

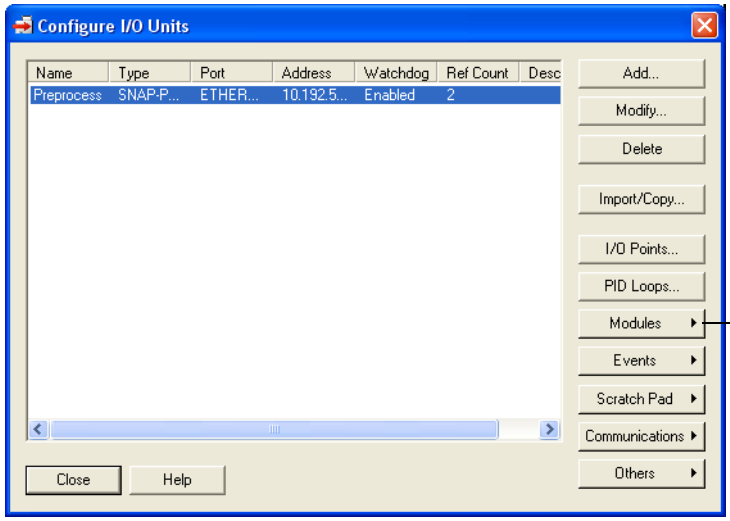
- 1 start bit (not configurable)
- 9600 baud

- No parity
- 8 data bits
- 1 stop bit
- No handshaking
- Send a test message when the module is turned on.
- SNAP-SCM-232: No flow control
- SNAP-SCM-485-422: 2-wire mode

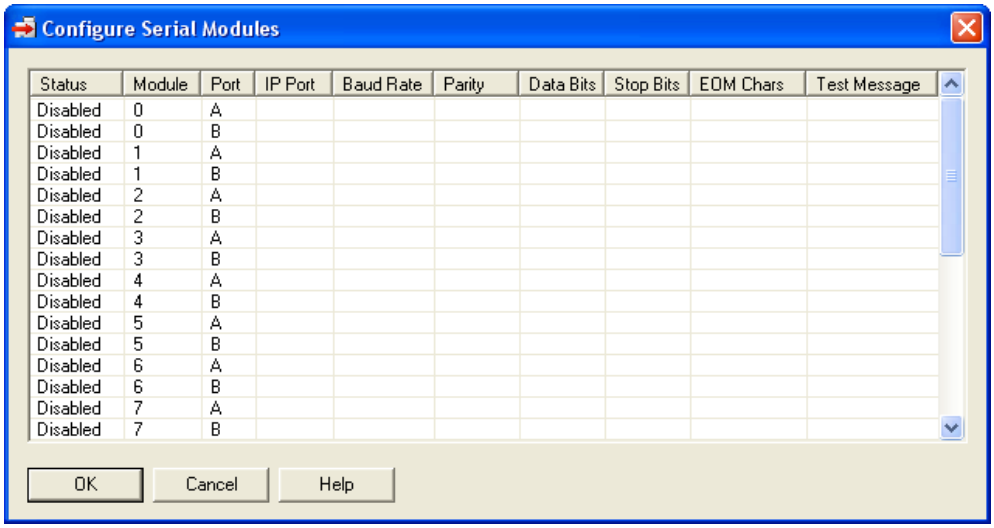
Port numbers and all parameters except the last two (flow control and 2- or 4-wire mode) can be changed in the I/O unit's configuration file using the following steps. For flow control and 2- or 4-wire mode, see the steps on page 50.

1. With the configuration file open, right-click the name of the I/O unit the serial module is on. From the pop-up menu, choose Configure.

The Configure I/O Units dialog box opens:



2. Make sure the correct I/O unit is highlighted. Click the Modules button and choose Serial Modules from the pop-up menu.



3. Click the status cell for the module number and port number whose parameters you want to change. From the pop-up menu, choose Enabled.

   The Status changes to Enabled.

4. To change a communication parameter, click the cell you want to change within the highlighted line. Choose from the drop-down list, if there is one, or type the new value in the cell.

   NOTE: The start bit is not configurable. To set flow control and 2- or 4-wire mode, see the steps on page 50.

5. When you have finished changing parameters for serial modules, click OK to close the dialog box and return to configuring I/O units.

IMPORTANT: *If you have changed an IP Port number, you must save the change to flash and restart the I/O unit when you send the configuration data to the I/O unit (see page 67).*

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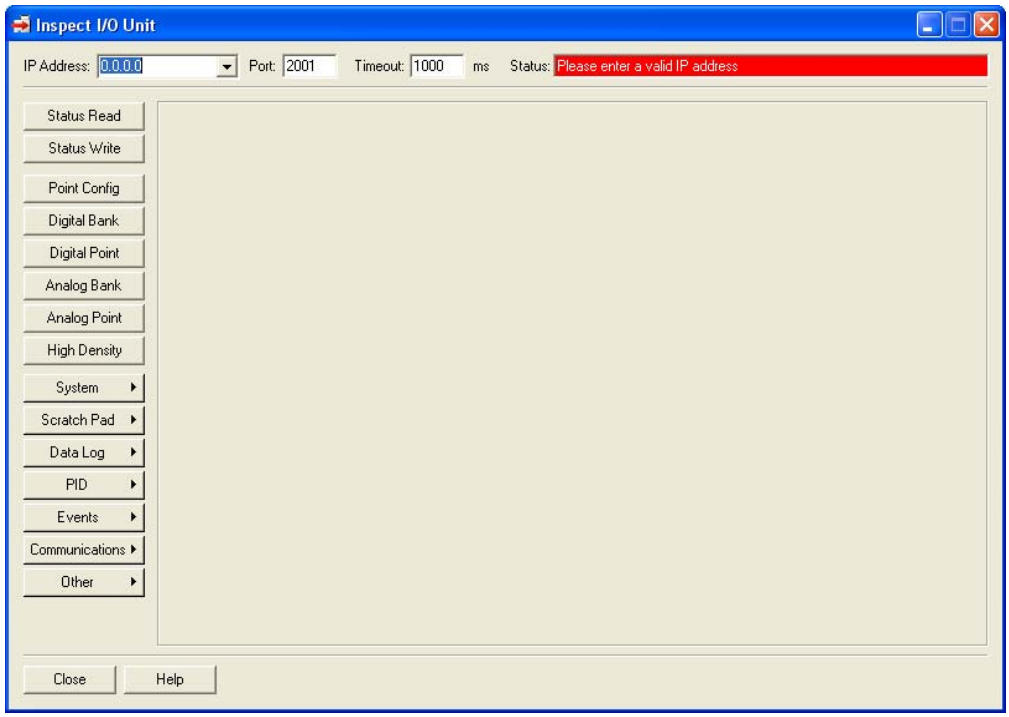
Configuring Flow Control and 2- or 4-Wire Mode

IMPORTANT: *You can configure flow control on a SNAP-SCM-232 and 2- or 4-wire mode on a SNAP-SCM-485-422 using PAC Manager. However, these configurations cannot be saved to the configuration file. The I/O unit that contains the serial module must be on the same network as your PC, and the configuration is sent directly to the I/O unit.*

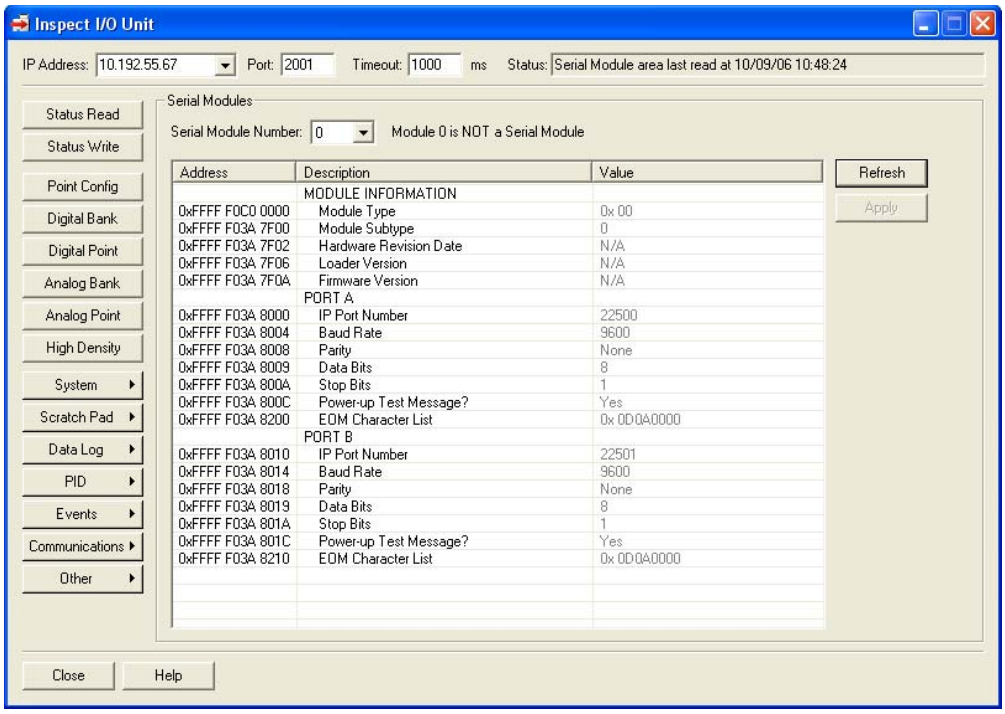
1. In the PAC Manager main window, click the Inspect button .



If this is the first time you have used the Inspect button, the IP address will show 0.0.0.0, as shown above. If you have used the Inspect button before, the last IP address you used is shown, and the most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the I/O unit (or choose it from the drop-down list). Click the Communications button and choose Serial Modules from the pop-up menu.

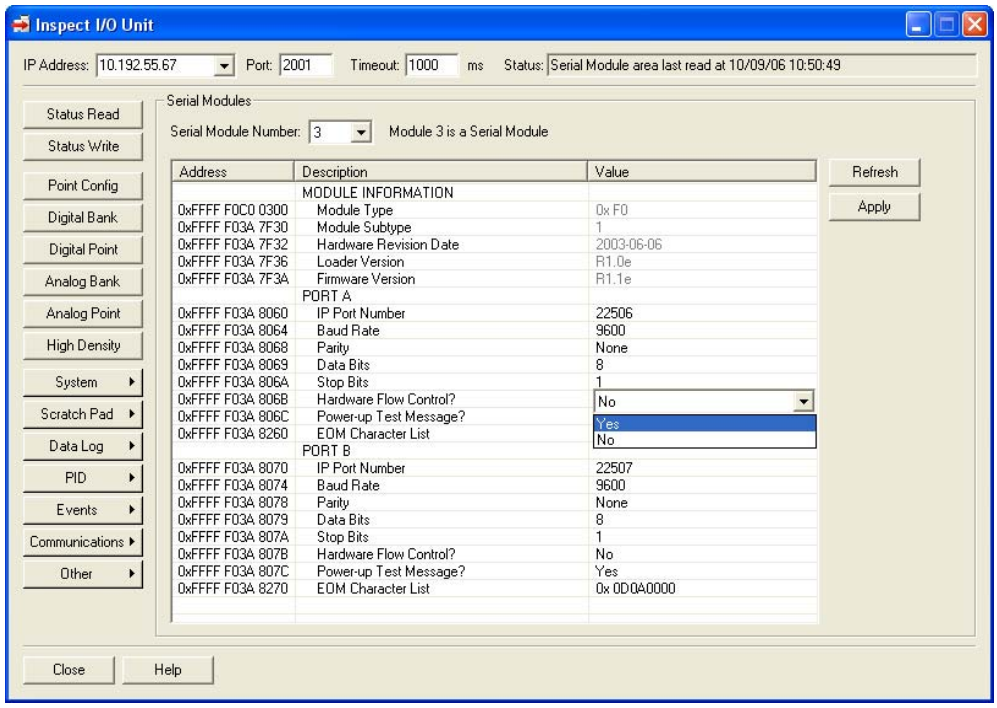
Information from the I/O unit is displayed in the window:



3. Click the Serial Module Number drop-down list and choose the module's position number on the rack to see the module's communication parameters.
4. To change a parameter, click its value in the Value column and choose from the drop-down list or enter a new value.

NOTE: *This is the only way to change hardware flow control for a SNAP-SCM-232 or 2- or 4-wire mode for a SNAP-SCM-485-422. You can also change other parameters in this dialog box if necessary. However, parameters changed in this dialog box are NOT saved to the configuration file.*

This example shows how to change Hardware Flow Control on a SNAP-SCM-232:



5. When you have finished changing parameters for this module, click Apply.

   The configuration changes are sent to the I/O unit.

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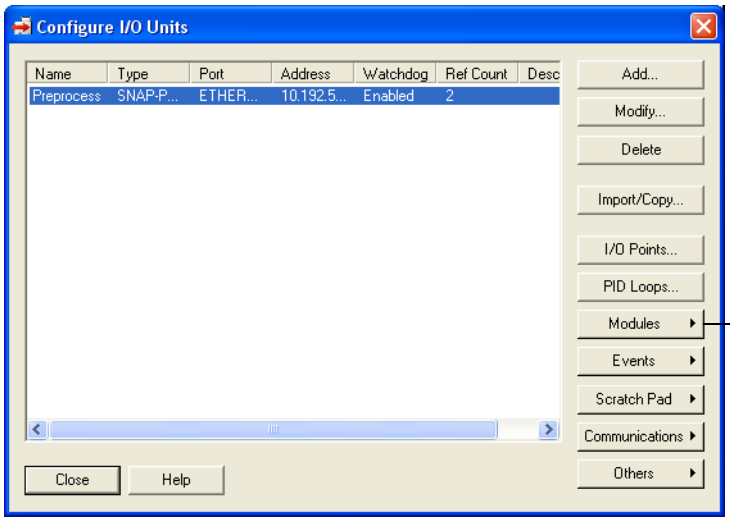
Configuring Profibus Modules

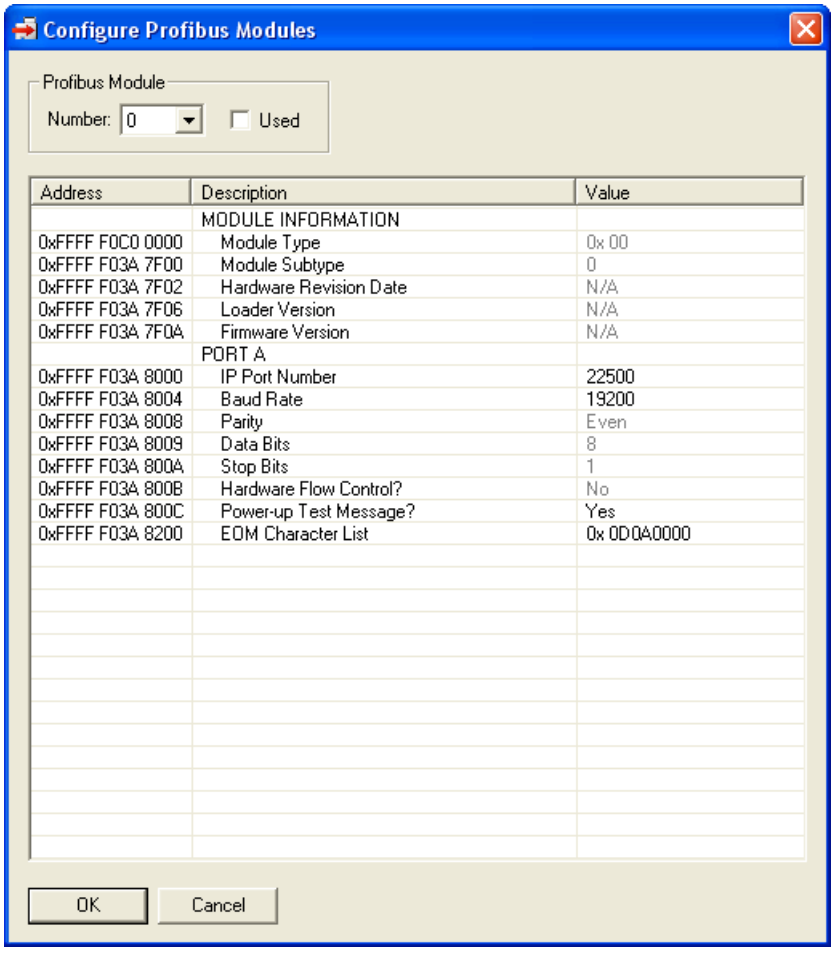
Profibus modules (part number SNAP-SCM-PROFI) are a special type of serial module. Before configuring a Profibus module, see Opto 22 form #1191, the *SNAP Serial Communication Module User's Guide*, for more information about these modules.

1. With the configuration file open, right-click the name of the I/O unit the Profibus module is on. From the pop-up menu, choose Configure.

The Configure I/O Units dialog box opens:



2. Make sure the correct I/O unit is highlighted. Click the Modules button and choose Profibus Modules from the pop-up menu.


Configure Profibus Modules
Profibus Module
Number: 0
Used
Address
Description
Value
MODULE INFORMATION
0xFFFF F0C0 0000 Module Type 0x 00
0xFFFF F03A 7F00 Module Subtype 0
0xFFFF F03A 7F02 Hardware Revision Date N/A
0xFFFF F03A 7F06 Loader Version N/A
0xFFFF F03A 7F0A Firmware Version N/A
PORT A
0xFFFF F03A 8000 IP Port Number 22500
0xFFFF F03A 8004 Baud Rate 19200
0xFFFF F03A 8008 Parity Even
0xFFFF F03A 8009 Data Bits 8
0xFFFF F03A 800A Stop Bits 1
0xFFFF F03A 800B Hardware Flow Control? No
0xFFFF F03A 800C Power-up Test Message? Yes
0xFFFF F03A 8200 EOM Character List 0x 0D0A0000
OK
Cancel

3. In the Number field, choose the Profibus module's position from the drop-down list. Click to put a check mark in the Used box.
4. If you need to change port numbers, enter the new numbers for each port in the IP Port Number field.
5. Change the Baud Rate and EOM Character List fields if necessary to match your Profibus devices. Choose whether to have the module automatically send a Test Message when turned on (the default is Yes).
6. When data is correct, repeat from step 3 for additional Profibus modules.
7. When all Profibus modules are configured, click OK to close the dialog box and return to configuring I/O units.

IMPORTANT: *If you have changed an IP Port number, you must save the change to flash and restart the I/O unit when you send the configuration data to the I/O unit (see page 67).*

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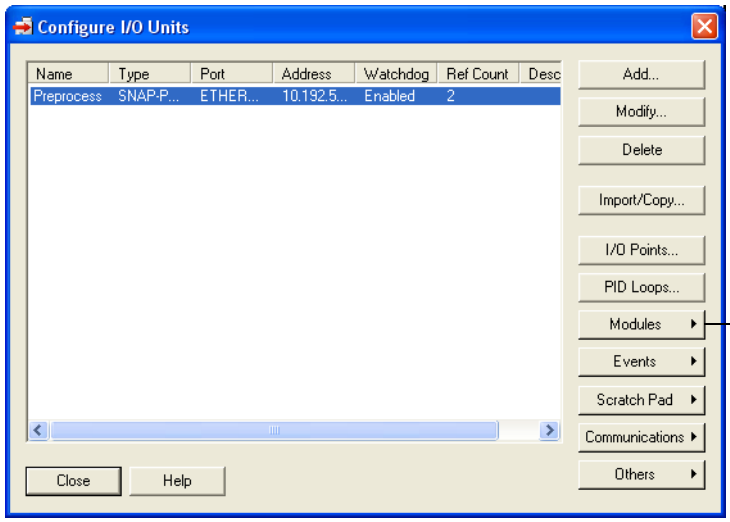
Configuring Wiegand Modules

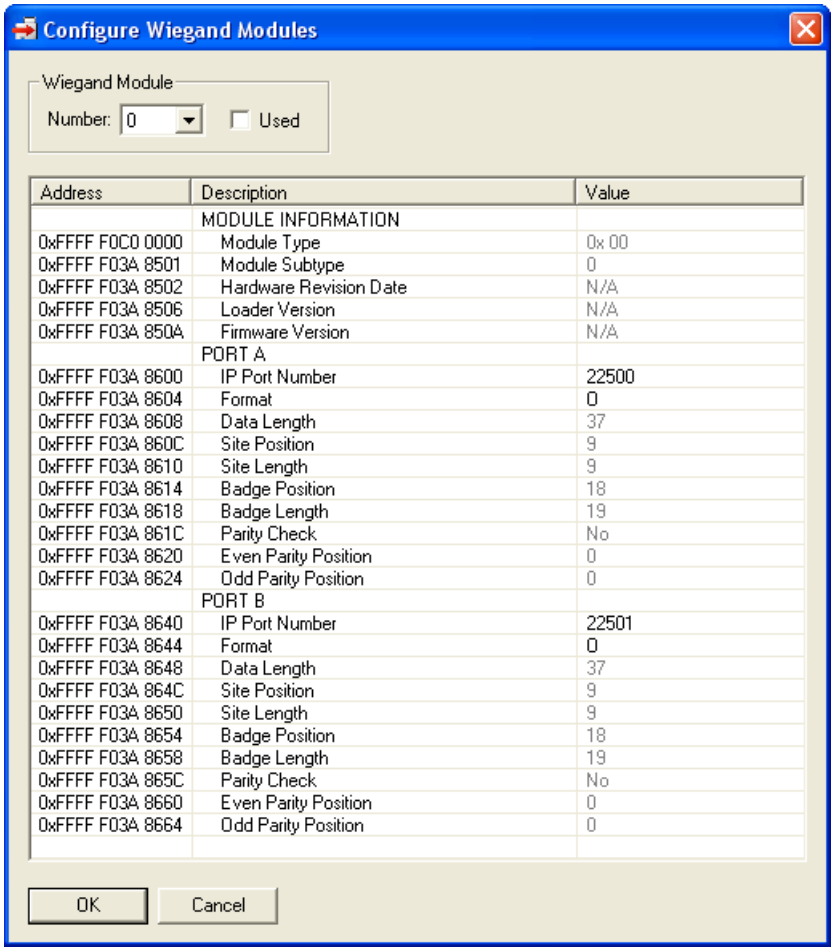
Wiegand modules are a special type of serial module. Before configuring a Wiegand module, see Opto 22 form #1191, the *SNAP Serial Communication Module User's Guide*, for more information about these modules.

1. With the configuration file open, right-click the name of the I/O unit the Wiegand module is on. From the pop-up menu, choose Configure.

   The Configure I/O Units dialog box opens:



2. Make sure the correct I/O unit is highlighted. Click the Modules button and choose Wiegand Modules from the pop-up menu.


Configure Wiegand Modules
Wiegand Module
Number: 0
Used
Address
Description
Value
MODULE INFORMATION
0xFFFF F0C0 0000 Module Type 0x 00
0xFFFF F03A 8501 Module Subtype 0
0xFFFF F03A 8502 Hardware Revision Date N/A
0xFFFF F03A 8506 Loader Version N/A
0xFFFF F03A 850A Firmware Version N/A
PORT A
0xFFFF F03A 8600 IP Port Number 22500
0xFFFF F03A 8604 Format 0
0xFFFF F03A 8608 Data Length 37
0xFFFF F03A 860C Site Position 9
0xFFFF F03A 8610 Site Length 9
0xFFFF F03A 8614 Badge Position 18
0xFFFF F03A 8618 Badge Length 19
0xFFFF F03A 861C Parity Check No
0xFFFF F03A 8620 Even Parity Position 0
0xFFFF F03A 8624 Odd Parity Position 0
PORT B
0xFFFF F03A 8640 IP Port Number 22501
0xFFFF F03A 8644 Format 0
0xFFFF F03A 8648 Data Length 37
0xFFFF F03A 864C Site Position 9
0xFFFF F03A 8650 Site Length 9
0xFFFF F03A 8654 Badge Position 18
0xFFFF F03A 8658 Badge Length 19
0xFFFF F03A 865C Parity Check No
0xFFFF F03A 8660 Even Parity Position 0
0xFFFF F03A 8664 Odd Parity Position 0
OK
Cancel

3. In the Number field, choose the Wiegand module's position from the drop-down list. Click to put a check mark in the Used box.
4. If you need to change port numbers, enter the new numbers for each port in the IP Port Number fields.
5. Click the Format/Value cell, and from the drop-down list, choose a standard data format (shown by its total data length) or choose C for custom.

   NOTE: 0 is the 37-bit Opto 22 format used in a sample PAC Control strategy available for use with Wiegand modules. See the Serial Communication Module User's Guide *for more information.*

6. Change the following fields if necessary to match your Wiegand hardware device:

   Data Length—total length of data in the transmission
   Site Position—first bit of the site code
   Site Length—length of the site code, in bits
   Badge Position—first bit of the badge code (should be the next bit after the site code)
   Badge Length—length of the badge code, in bits

7. When data for both ports is correct, repeat from step 3 for additional Wiegand modules.

8. When all Wiegand modules are configured, click OK to close the dialog box and return to configuring I/O units.

IMPORTANT: *If you have changed an IP Port number, you must save the change to flash and restart the I/O unit when you send the configuration data to the I/O unit (see page 67).*

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Configuring PID Modules

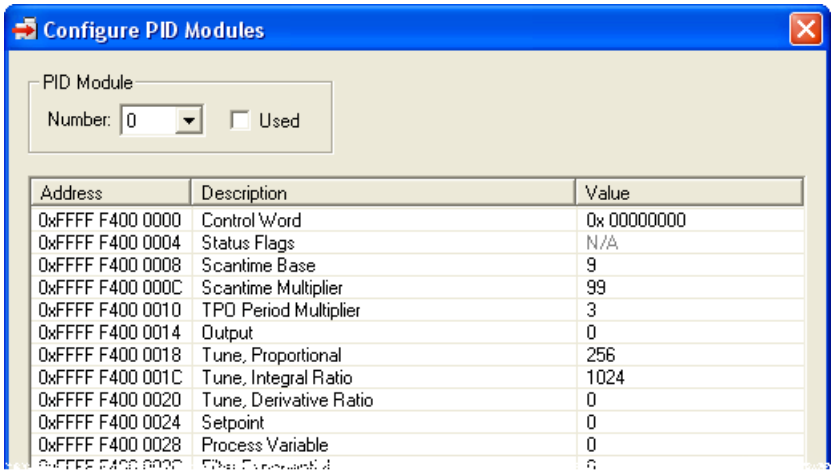
NOTE: This section is for PID modules. ***These modules are not recommended for new development.*** *Instead, use the PID loops provided on the I/O unit itself. SNAP PAC R-series I/O units provide 96 PID loops; SNAP Ultimate I/O units provide 32; SNAP Ethernet I/O units provide 16. See page 61.*

To configure PID modules, you will also need Opto 22 form #1263, the *SNAP PID Module User's Guide*, available on our Web site at www.opto22.com.

1. In the Configure I/O Points dialog box, double-click the number that represents the PID module's position on the rack.
2. In the Add Module dialog box, choose Analog Input as the type and then choose SNAP-PID-V as the module. Click OK.

   The module appears in the Configure I/O Points dialog box.
3. Close the Configure I/O Points dialog box and return to the Configure I/O Units dialog box. Choose one of the following ways to enter PID values and set parameters for a SNAP-PID-V module:
   - If you want to iteratively tune a PID loop, use OptoENET PID Module Tuner. This software includes graphing features and is available free from the Opto 22 Web site. See the PID module user's guide for instructions; do NOT continue with the following steps.
   - If you have previously calculated PID values and parameters, use PAC Manager. PAC Manager does not provide visual feedback of changes to PID values. You must first calculate optimal PID values for your application using the PID velocity algorithm and the PID variable formulas described in the PID module user's guide. After calculating these values, continue with step 4.

4. In the Configure I/O Units dialog box, click the Modules button and choose PID Modules from the pop-up menu.



5. From the Number drop-down list, choose the number of the PID module on the rack.
6. Click to place a check mark in the Used box.
7. For each item you want to set, click its cell in the Value column and change the value.

   For descriptions of items, see the PID module user's guide.
8. Repeat for each PID module you want to configure.
9. When you have finished configuring PID modules, click OK to close the dialog box and return to configuring I/O units.

   When you are ready to send all configuration data to the I/O unit, see page 67.

PAC-REB UIO EIO SIO

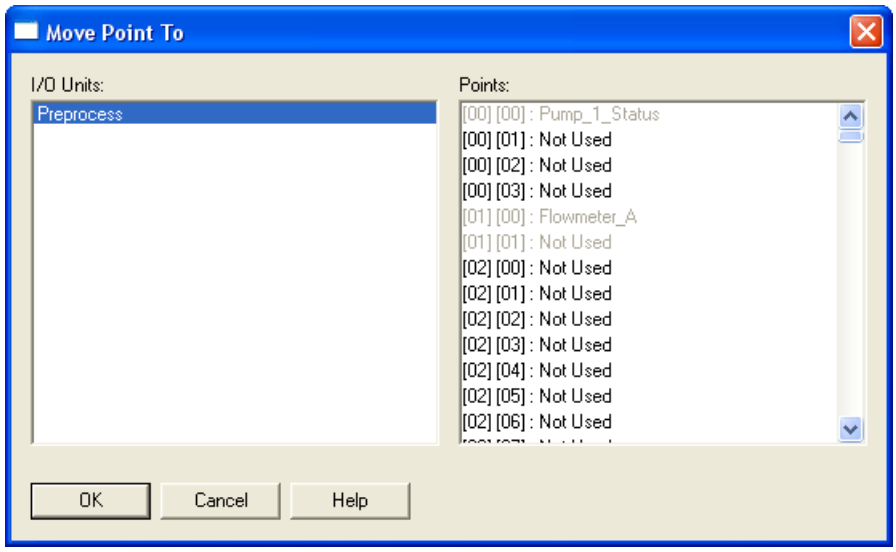
Moving a Configured I/O Point

You can move a configured I/O point to an empty point on the same I/O unit or on a different unit.

1. In the Configure I/O Unit dialog box, highlight the unit the point is on and click I/O Points.

   The Configure I/O Points dialog box opens.

2. If necessary, expand the modules by clicking Expand All.
3. Highlight the point you want to move and click Move To.



4. In the Points area of the Move Point To dialog box, highlight the location you are moving the point to. Then click OK.

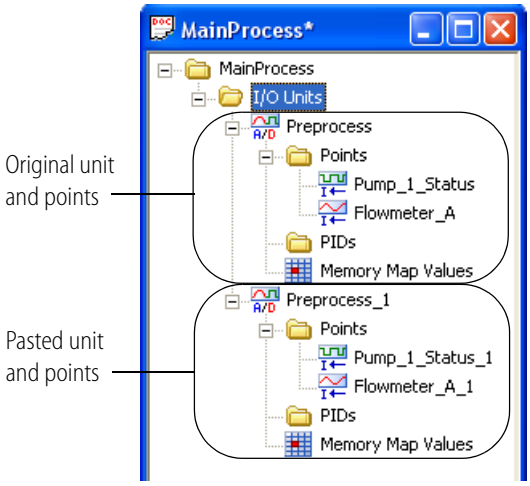
   You return to the Configure I/O Points dialog box, and the point has been moved.

Copying and Pasting I/O Units

PAC-R
EB
UIO
EIO
SIO

You can copy configured I/O units and paste them into the same configuration file or into another configuration file.

1. In the configuration tree, right-click the name of the I/O unit. From the submenu, choose Copy.
2. Choose one of the following:
   - To paste the I/O unit into the same configuration file, right-click the I/O Units folder and choose Paste from the submenu. The I/O unit is pasted. As shown in the graphic at right, the names of the pasted I/O unit and points are the same as the originals, except with an underscore and a number added.
   - To paste the I/O unit into a different configuration file, close the first file, and then open the file into which you want to paste the I/O unit. Right-click the I/O Units folder in the configuration tree. From the submenu, choose Paste. The I/O unit is pasted. To see it in the configuration tree, you can click the plus sign to expand the folder.



3. To change the name or configuration of the pasted I/O unit, double-click it. Make the changes in the Edit I/O Unit dialog box and then click OK.
4. To change the name or configuration of a point on the pasted unit, double-click the point's name. Make changes in the dialog box and then click OK.

Configuring PID Loops

NOTE: This section applies only to PID loops on Ethernet-based I/O units (SNAP PAC, SNAP Ultimate, and SNAP Ethernet). It does not apply to PID loops on mistic brains, such as the B3000 serial. PID loops for mistic brains used with PAC Control must be configured in PAC Control.

PAC-R
EB
UIO
EIO

What is a PID?

PID loops (or simply PIDs) are used to drive an input (process variable) toward a particular value (the setpoint) and keep the input very close to that value by controlling an output. For example, consider temperature control, where the input is a measurement of ambient temperature, the setpoint is the desired temperature, and the output is a heater. A PID will use a mathematical formula (*algorithm*) that controls the output to maintain a desired temperature, efficiently adjust to changes in setpoint, and compensate for changes in load, such as the influx of cold air. In this example, a temperature sensor (analog input), a thermostat (analog input), and a heater control (analog output) are components of one system, controlled by a PID loop.

This guide assumes that you are already familiar with using PIDs. PID calculations are complex and the physical qualities of systems suitable for PID control differ greatly. This guide includes only basic information for configuring PIDs on SNAP Ethernet-based I/O units.

SNAP PAC R-series I/O units support 96 PID loops per I/O unit; SNAP PAC EB I/O units support 32 PID loops per I/O unit. Analog/digital SNAP Ultimate I/O units support 32 PID loops per I/O unit, and SNAP Ethernet I/O units support 16. (SNAP Simple I/O units do not have PID capability.) These PIDs can control isolated systems or be part of cascaded systems where one loop controls the setpoints or input variables of others.

NOTE: On SNAP PAC R-series and SNAP Ultimate, PID loops run on the I/O side, independent of any PAC Control strategy. Once it starts running, a PID continues running until the I/O unit loses power or the PID is set to Manual. If you subsequently download a different strategy to the control engine, you'll receive an error message (-700) reminding you that a PID loop is still running and that it may conflict with the new stragegy. To turn off the PID loop, use Inspect mode in PAC Manager to change the PID's algorithm to None.

Each PID must be configured with essential parameters and then individually tuned for efficiency. You can configure PIDs through either PAC Manager or PAC Control. For tuning PIDs, it's easier to use the graphic tuning tools in PAC Control (see Opto 22 form #1700, the *PAC Control User's Guide*).

NOTE: PID capabilities in SNAP Ethernet I/O units are compatible with PAC Control, but not with OptoControl.

If you are not using PAC Control, it is possible to configure and tune PIDs through the I/O unit's memory map. The memory map is in form #1465, the *OptoMMP Protocol Guide*.

For additional help with PIDs, see Opto 22 form #1641, *OptoTutorial: SNAP PAC PID*.

Algorithm Choices

Four algorithms are available to choose from when configuring a PID loop for a SNAP Ethernet-based I/O unit:

- Velocity
- ISA
- Parallel
- Interacting

The ISA, Parallel and Interacting algorithms are functionally equivalent; the only difference is the way the tuning constants are factored. The identical and differing equations for all algorithms are shown in the following sections.

Key to Terms Used in Equations

PV	Process variable; the input to the PID
SP	Setpoint
InLo, InHi	Range of the input
OutLo, OutHi	Range of the output
Gain	Proportional tuning parameter. Unitless. May be negative.
TuneI	Integral tuning parameter. In units of 1 seconds. Increasing magnitude increases influence on output.

TuneD	Derivative tuning parameter. In units of seconds. Increasing magnitude increases influence on output.
Output	Output from the PID
Err_1	The Error (PV – SP) from the previous scan
Integral	Integrator. Anti-windup is applied after the output is determined to be within bounds.
PvIn_1, PvIn_2	PV from the previous scan and the scan before that.
ScanTime	Actual scan time (time since previous scan)

Equations Common to All Algorithms

```
Err = PV - SP
Span = (OutHi - OutLo) / (InHi - InLo)
Output = Output + FeedForward * TuneFF
```

Velocity Algorithm

The velocity algorithm is similar to the algorithm used in legacy software OptoControl for mistic I/O, except that the derivative does not act on setpoint changes.

```
TermP = ( Err - Err_1 )
TermI = TuneI * ScanTime * Err
TermD = TuneD / ScanTime * ( PvIn - 2 * PvIn_1 + PvIn_2 )
ΔOutput = Span * Gain * ( ΔTermP + ΔTermI + ΔTermD )
```

Non-velocity Algorithms

These equations were derived from the article "A Comparison of PID Control Algorithms" by John P. Gerry in *Control Engineering* (March 1987). These three equations are the same except for the tuning coefficients; converting from one equation to another is merely a matter of converting the tuning coefficients.

Equations common to all but the velocity algorithm:

```
Integral += Err
TermP = Err
TermI = TuneI * ScanTime * Integral
TermD = TuneD / ScanTime * ( PvIn - PvIn_1 )
```

"Ideal" or ISA Algorithm

```
Output = Span * Gain * ( TermP + TermI + TermD )
```

"Parallel" Algorithm:

```
Output = Span * ( Gain * TermP + TermI + TermD )
```

"Interacting" Algorithm:

```
Output = Span * Gain * ( TermP + TermI ) * ( 1 + TermD )
```

NOTE: In SNAP Ethernet-based PIDs, the derivative is applied only to the process variable (the input) and not to the setpoint. This means you can change the setpoint without causing spikes in the derivative term. These PIDs also prevent integral windup by back calculating the integral without the derivative term. The feed forward term ("bias") is added before output clamping and has a tuning factor.

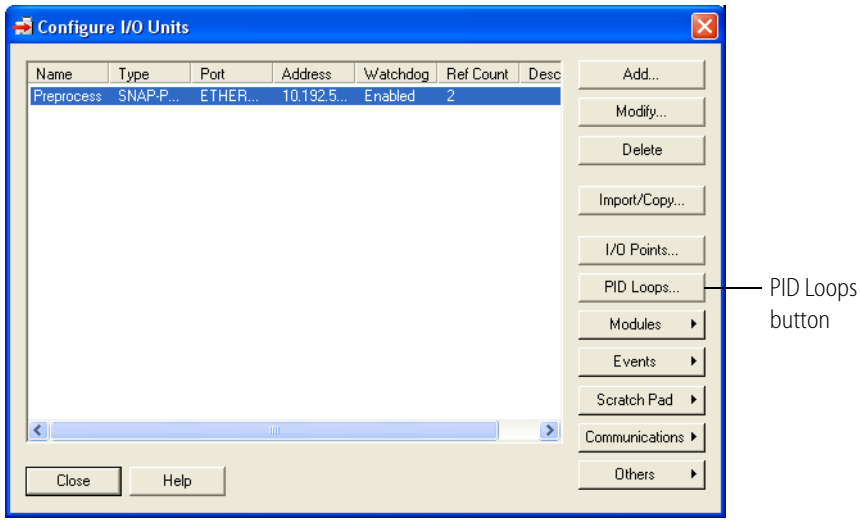
PAC-R EB UIO EIO

Steps for Configuring PIDs

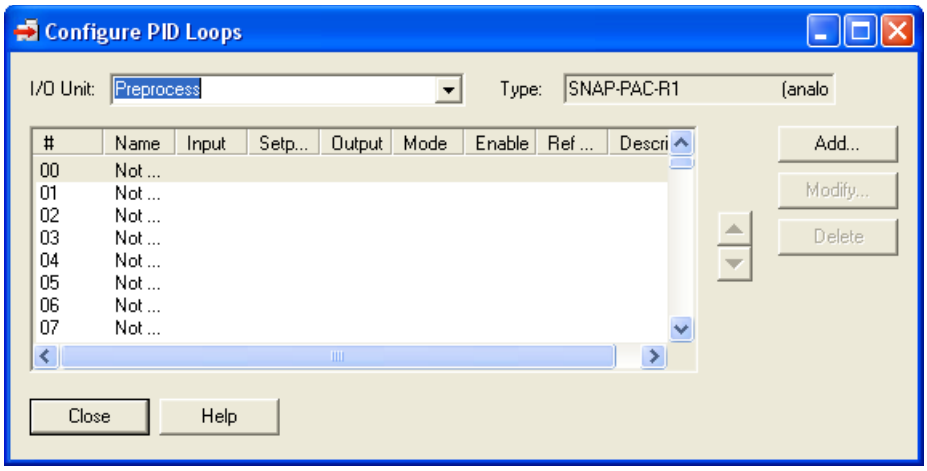
NOTE: This section applies only to PIDs on SNAP PAC, SNAP Ultimate, and SNAP Ethernet I/O units.

1. With the configuration file open, right-click the name of the I/O unit the PID will be on. From the pop-up menu, choose Configure.

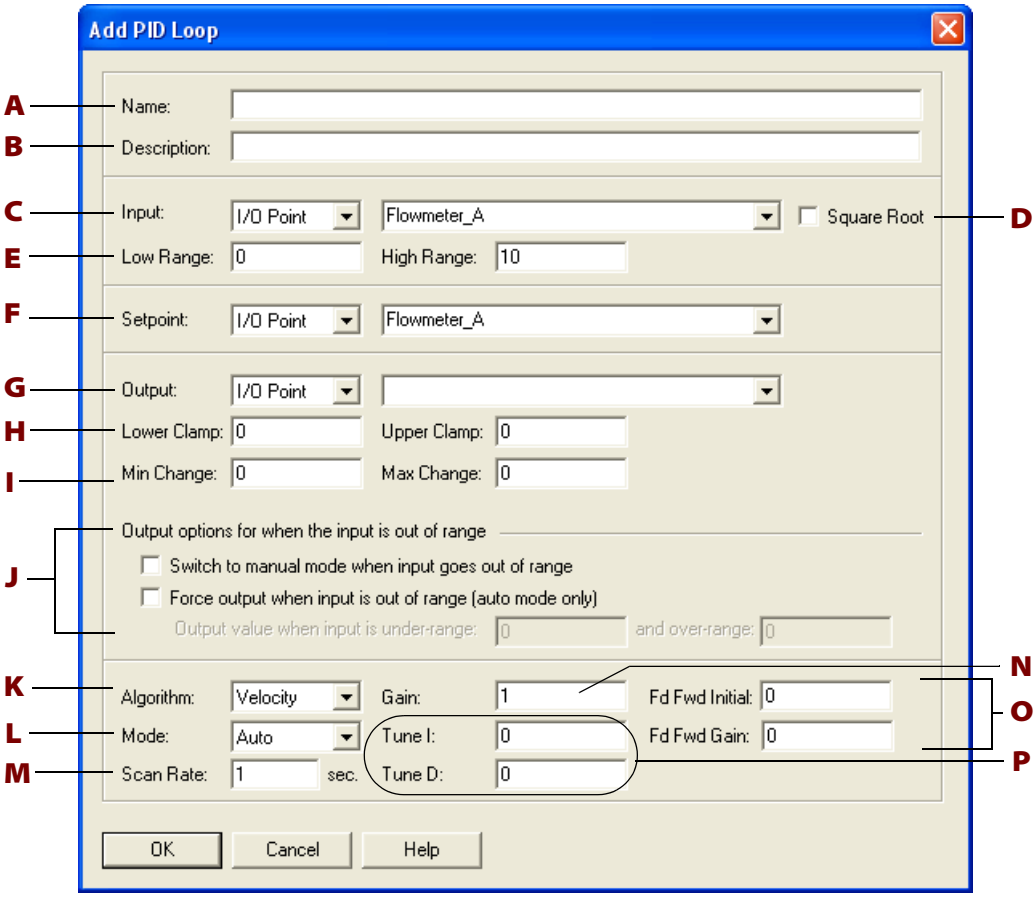
   The Configure I/O Units dialog box opens:



2. Make sure the correct I/O unit is highlighted. Click the PID Loops button.



3. Double-click the lowest unused PID number.



4. Complete the fields as follows:
   - **A** Type a unique, descriptive name for the PID.
   - **B** (Optional) Enter a description of the PID.

C Select the type of input: I/O Point, Host, or PID Output.

If the PID's process variable comes from an I/O point on the same unit, select I/O Point. Choose the point from the dropdown list or type a point name to configure a new point.

If the PID's process variable comes from a PAC Control strategy, select Host. Enter an initial value for the input.

If the PID's process variable is the output of another PID on this I/O unit (a cascading control loop), select PID Output. Choose the PID from the dropdown list.

D (Optional) If you chose I/O Point or PID for step C, check this box if the error should be calculated based on the square root of the process variable (applies to flow control systems where volumetric flow is proportional to the square root of a signal from a flow transducer).

E Set the valid range of the process variable by entering the low range and the high range. (See **J** for optional responses to out-of-range input.)

F Choose the source for the setpoint: I/O Point, Host, or PID Output.

To control the setpoint using a device such as a potentiometer, select I/O Point; choose an I/O point from the dropdown list or type a new point name.

To control setpoint using PAC Control or PAC Display, select Host and enter an initial value.

If another PID loop will control the setpoint, select PID Output and choose the PID from the dropdown list.

G Choose the destination for the PID output: I/O Point or Host. (To use the output for controlling the setpoint or input of another PID, choose Host.)

H Enter upper and lower clamp values to prevent the output from exceeding a desirable range. These values should equal the range of the output point, if used. Or choose values to make sure that the output device doesn't shut off (for example, keeping a circulation pump running regardless of the PID output) or that the output never reaches a destructively high setting (for example, keeping a motor below maximum).

I (Optional) Enter minimum and maximum change values. The output won't respond until the minimum change is reached (for example, you may not want a heater to turn on to correct a 1 degree error). Maximum change prevents too drastic a change in output (for example, you could limit the increase in a pump's output to prevent pipe breakage). The default for both minimum and maximum is zero, which disables the feature.

J Choose how the PID should respond if the input goes out of range. If no boxes are checked, the PID will freeze output at the current value. To have PAC Control logic or an operator respond, check Switch to manual mode. To force the output to a specific value, check Force output and type the output values. NOTE: If both boxes are checked (forced output and manual mode), the output will be forced and the PID put into manual mode; but if the PID is already in manual mode, the output will not be forced.

K Choose algorithm: Velocity, ISA, Parallel, Interacting. See page 62.

L Choose Mode. Auto activates the PID. Manual requires that PAC Control logic or an operator control the PID output.

M Enter a scan rate to determine how often the input is scanned and the controller output is calculated. Minimum value is 0.001 (1 millisecond). Scan time should be greater than

system lag (the time it takes for the controller output to have a measurable effect on the system). Also consider other PIDs and tasks on the I/O unit competing for processing power.

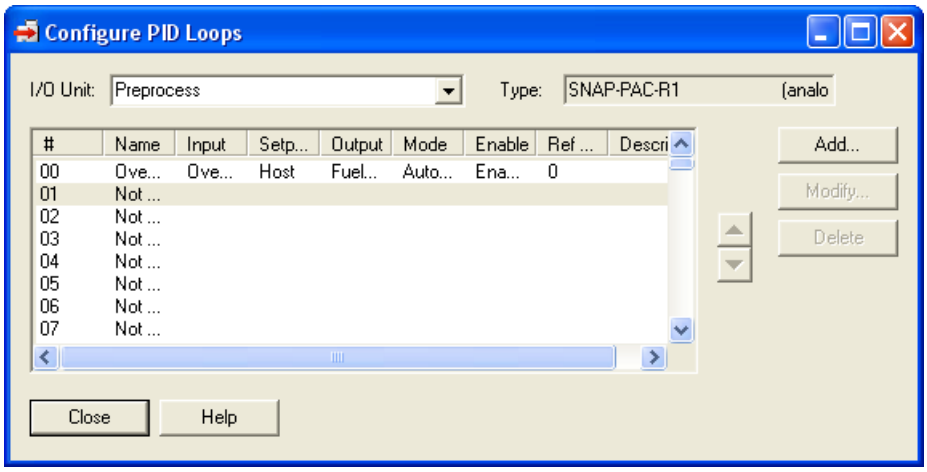
N Enter a positive or negative value for Gain. Heating systems usually require a negative value and cooling systems a positive value. NOTE: Gain is usually refined during the tuning process.

O (Optional) Enter Feed Forward Initial and Feed Forward Gain values if you need to offset the controller output in your application. These values are constants that are multiplied and added to the controller output; often they are not used in PIDs.

P (Optional) Enter Integral and Derivative settings if you know the desirable settings. However, Integral and Derivative are not essential to basic configuration and are better determined in the tuning process.

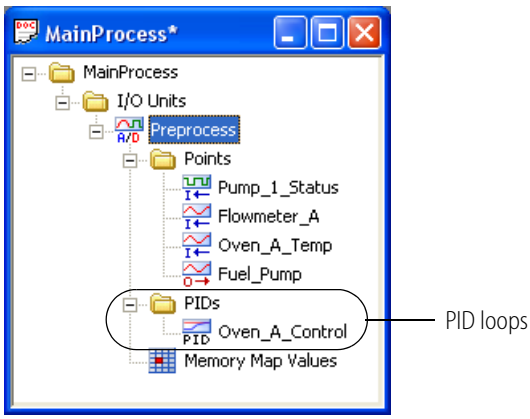
5. Click OK.

The new PID appears in the list:



6. When you have finished configuring PIDs, click Close.

PIDs appear in the configuration tree under the I/O unit:



Sending Configuration Data to the I/O Unit

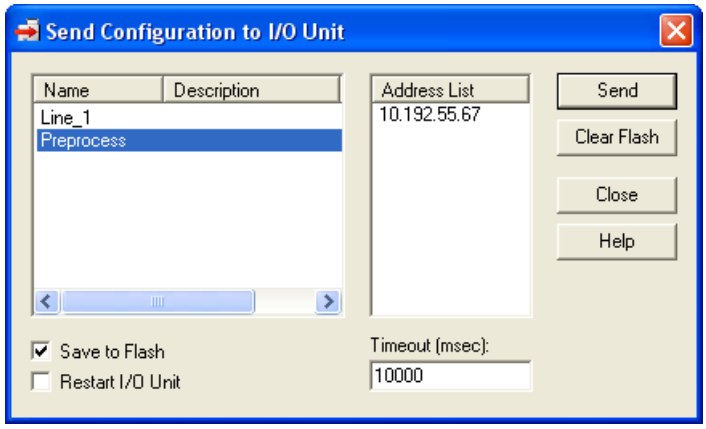
PAC-REB UIO EIO SIO

After you have configured I/O units and set up optional functions such as security, email, and SNMP from Chapter 3, you must load the configuration file onto the I/O unit.

You can load the configuration file into RAM only, or you can save it to flash memory at the same time. If you don't save to flash, the configuration is lost if the I/O unit is turned off. When you save to flash, the new configuration overwrites any configuration already in the flash memory. Note that for some functions, you must save to flash and restart the I/O unit for the configuration to take effect.

1. With the configuration file open, choose Tools→Send Configuration to I/O Unit.

   The Send Configuration dialog box appears:



   The list on the left shows all the I/O units in this configuration file. When you click a unit, the Address List shows the IP addresses for all I/O units associated with the highlighted unit. This is the address list you set up in the Add I/O Unit dialog box, shown on page 36.

2. Highlight the I/O unit configuration(s) you want to send.
3. Highlight the IP addresses to receive the I/O unit configuration.

   If you don't highlight any addresses, the configuration will be sent to the entire list.

   NOTE: If you highlighted more than one unit configuration, each unit configuration will automatically be sent to all the IP addresses associated with it.

4. If necessary, change the Timeout field.

   The timeout field shows how long, in milliseconds, PAC Manager will try to communicate with the I/O unit before returning a timeout error.

5. To save the configuration file to flash memory as well as to RAM, check Save to Flash. To also restart the unit, check Restart I/O Unit.

   ***IMPORTANT:** For the following configurations, you must save to flash and restart the unit in order for configuration to take effect:*

   Changes in IP port for serial modules
   Email configuration
   Data logging interval
   SNMP configuration
   PPP configuration

NOTE: *PID loops are saved, but PID* module *settings are* ***not*** *saved when you cycle power to the I/O unit and the PID module. PID module settings cannot be saved to the I/O unit's flash memory. If you turn off power to these components, you will need to reenter PID module settings using either PAC Manager or the OptoENET PID Module Tuner software.*

6. Click Send.

   The configuration data is sent to the I/O units whose IP addresses you chose.

PAC-R EB UIO EIO SIO

Using PAC Manager to Clear Flash Memory

You can also use PAC Manager to clear configuration data from flash memory in one or more I/O units. (This action does not affect brain or controller firmware, strategy files, or files from the I/O unit's file system that may be stored to flash.)

1. With the configuration file open, choose Tools→Send Configuration to I/O Unit.
2. In the Send Configuration dialog box, highlight the I/O unit configuration and IP addresses for the I/O units you want to clear.
3. Click Clear Flash.

   Configuration data in flash memory is cleared.

Using I/O Point Features

PAC-R EB UIO EIO SIO E1 E2

The I/O point features available on SNAP Ethernet-based I/O units depend on the combined capabilities of the I/O processor (brain, brain board, or on-the-rack controller), the module, and in some cases, the protocol used. See page 5 to determine which features are available for the processor you are using. Note that some features (such as ramping and pulsing) are currently available only through PAC Control, not through PAC Manager. These features are not shown in the list below. See the *PAC Control User's Guide* for more information.

The following table defines the features. See the referenced pages for more information.

Feature	Description	See
States	(digital input and output)—A digital point is either on or off. You can read the current state of a digital input or write an on/off state to a digital output.	page 70
Latches	(digital input)—When the value of a digital input point changes from off to on, an on-latch is automatically set. While the value of the point may return to off, the on-latch remains set, as a record of the change, until you clear it. Similarly, an off-latch is set when the value of a digital point changes from on to off, and it remains set until cleared.	page 70
Counters	(digital input)—A counter keeps track of the number of times a digital input changes from off to on. The count accumulates until it reaches the maximum count available in the I/O unit or until you reset the counter to zero. For example, to count the number of widgets produced per shift, you would clear the counter at the start of each shift and read it at the end of each shift. For points on a 4-channel module, the speed of the counter depends upon the brain or controller's capabilities and the speed of the module used. For points on a high-density module, counting is done in the module.	page 71

Feature	Description	See
Quadrature counters	(digital input)—A quadrature counter requires a SNAP quadrature input module, which is attached to the encoder device. The module sends a pulse to the I/O unit upon each change in quadrature state, and the I/O unit counts the pulses and keeps track of the direction and rotation.	page 71
Watchdog	(digital and analog input and output)—A watchdog monitors communication with the PC or other host device. If the host does not write data to the I/O unit for the length of time set in the watchdog, the I/O unit automatically sets designated digital and analog output points to the values you have determined. A watchdog helps make sure that a communication failure doesn't result in disaster. If communication fails between the host and the I/O unit controlling a process, the watchdog makes sure the process is automatically brought to a safe state. For example, a valve could automatically close to avoid completely emptying a tank.	page 72
Scaling	(analog input and output)—Analog input and output points can be scaled as needed. For example, you can scale a -5 V to +5 V input point to reflect 0% to 100%	page 72
Minimum and maximum values	(analog input)—Minimum and maximum values are sometimes called peaks and valleys. You can read these values at any time, for example, to record minimum and maximum temperatures. You can also reset min/max values. For example, if you want to record the maximum temperature at point 2 in each 24-hour period, you must reset the values after they are read each day.	page 73
Thermocouple linearization	(analog input)—The I/O unit automatically converts the thermocouple junction's millivolt values into temperature values, so you don't have to. Choose the appropriate module and make sure you configure the point as the correct thermocouple type (E, K, etc.) for your purpose.	--
Offset and gain	(analog input)—Offset and gain calculations are used to calibrate analog points. If a -50 mV to +50 mV input receives signals that are slightly off (not exactly -50 mV at the lowest point, for example), the offset and gain can be calculated so that values will appear accurately when read.	page 73
Clamping	(analog output)—Clamping limits values that can be sent to analog output points so they do not go above or below a specific value. For example, if you are using a 0–10 VDC output module, but the device attached to one of its points can only handle a maximum of 5 VDC, you can set an upper clamp of 5 VDC for that point. The values for upper and lower clamp are set in engineering units.	page 73
PID loop control	(analog points)—Proportional integral derivative (PID) loops are used to drive an input toward a particular value (the setpoint) and keep the input very close to that value by controlling an output. PID loops are often used in temperature control.	page 61
Average filter weight	(analog inputs)—A filter weight smooths analog input signals that are erratic or change suddenly.	page 73

I/O point features are discussed in the following sections.

PAC-R
EB
UIO
EIO
SIO
E1

States (Digital Points)

You can read the ON or OFF state of a digital input point or write to a digital output point to turn it on or off.

For E1 brain boards, each point on the unit is treated like the first point on a SNAP module; that is, only the first of every four points contains data. For more information on interpreting data formats, see page 45.

PAC-R
EB
UIO
EIO
SIO
E1

Latches (Digital Points)

SNAP—Latching is available on both 4-channel and high-density digital points. It is automatic and needs no configuration. Using PAC Control digital point commands, you can read the on-latch or off-latch state of a digital point, and you can clear latches.

E1—Latching is available on all modules used with the E1. Note that latching is different on an E1 depending on the protocol used with the brain board. When the E1 is used with the Optomux protocol, only one latch is available and you must configure it to be an on-to-off latch or an off-to-on latch. When you use an E1 with PAC Control or OptoMMP, however, both types of latches are automatically available for each point, and no configuration is required.

To read and/or clear latches, use PAC Control digital point commandsmemory map values. Remember that each point on an E1 is treated like the first point on a SNAP module. For example, to read latches for modules in positions 0, 1, 2, and 3 using the Digital Point Read area of the memory map, read the following addresses:

This module position on E1:	0	1	2	3
Is like this module,point on SNAP:	0,0	1,0	2,0	3,0
Address for on-latch state:	F080 0004	F080 0104	F080 0204	F080 0304
Address for off-latch state:	F080 0008	F080 0108	F080 0208	F080 0308

PAC-R
EB
UIO
EIO
SIO
E1

Counters (Digital Points)

SNAP—Any SNAP digital input can be used as a counter. Note the differences in counting between 4-channel and high-density digital modules:

	SNAP 4-channel digital counters	SNAP high-density digital counters
Processor compatibility	SNAP-PAC-R1 SNAP-PAC-EB1 SNAP-B3000-ENET SNAP-ENET-RTC SNAP-UP1-ADS	SNAP-PAC-R1 SNAP-PAC-R2 SNAP-PAC-EB1 SNAP-PAC-EB2 SNAP-B3000-ENET SNAP-ENET-RTC SNAP-ENET-S64 SNAP-UP1-ADS SNAP-UP1-M64
Counting is done on...	...the brain	...the module
Counting speed	High speed (depends on speed of module; modules available up to 20 KHz)	Low speed (around 50 Hz)
Configuration	Each point to be used as a counter must be configured; counters are automatically activated when configured.	Configure points if using PAC Control. If not using PAC Control, counters are automatic.

Using PAC Control digital point commands, you can stop a counter if required and then start it again. You can also clear a counter, so it begins counting again from zero.

E1—Any digital input can be used as a counter. Follow the steps in form #1576, *I/O Configuration for E1 and E2 Brain Boards*, to configure counters before using them.

PAC-R
EB
UIO
EIO

Quadrature Counters (Digital Points)

I/O units with the following I/O processors support quadrature counters for quadrature encoder devices:

- SNAP-PAC-R1
- SNAP-PAC-EB1
- SNAP-UP1-ADS
- SNAP-B3000-ENET
- SNAP-ENET-RTC

A quadrature counter requires a SNAP quadrature input module, which is attached to the encoder device. The module sends a pulse to the processor upon each change in quadrature state, and the processor counts the pulses and keeps track of the direction and rotation. The counter counts up if quadrature Point A leads Point B; it counts down if Point A lags behind Point B. Each channel can have counts from 0 to 2,147,483,647.

When you configure the points on the quadrature input module, the quadrature counter feature is automatically included.

PAC-R
EB
UIO
EIO
SIO
E1
E2

Watchdog (Digital and Analog Points)

You can set a watchdog on a memory-mapped I/O unit when configuring the I/O unit. Then when you configure a digital (page 39) or analog (page 42) output point, you can choose the status or value the point should be set to if the watchdog timer expires.

For E1 and E2 I/O units, follow the steps in form #1576, *I/O Configuration for E1 and E2 Brain Boards*.

PAC-R
EB
UIO
EIO
SIO
E2

Scaling (Analog Points)

You can scale analog input or output points to match your needs. For example, you can scale a -5 V to +5 V input point to reflect 0% to 100%. Point types may be unipolar or bipolar.

Examples of Unipolar Points
4–20 mA analog output
0–10 A RMS analog input

Examples of Bipolar Points
-25 mV to +25 mV analog input
-10 to +10 VDC analog output

Unipolar and bipolar points are scaled in the same way, with the lowest reading reflecting the low scale and the highest reading reflecting the high scale. Here are two examples:

	Unipolar Input Point		Bipolar Input Point		
	Low scale	High scale	Low scale		High scale
Actual reading	0 mA	20 mA	-5 V	0 V	+5 V
Scaled for percentage	0%	100%	0%	50%	100%
Scaled for counts*	0	+25,000	-25,000	0	+25,000

*Counts for input points always range -25,000 to +25,000.

	Unipolar Output Point		Bipolar Output Point		
	Low scale	High scale	Low scale		High scale
Actual reading	4 mA	20 mA	-10 VDC	0 VDC	+10 VDC
Scaled for percentage	0%	100%	0%	50%	100%
Scaled for counts*	0	4,095	0	2,047.5	4,095

*Counts for output points always range 0–4,095.

To scale an analog point, see the instructions on page 45. EXCEPTION: For an E2 I/O unit, follow the steps in form #1576, *I/O Configuration for E1 and E2 Brain Boards*.

PAC-R
EB
UIO
EIO
SIO
E2

Minimum and Maximum Values (Analog Points)

All memory-mapped I/O units with analog capability automatically keep track of minimum and maximum values on analog points. You can read and clear these values using PAC Manager's Inspect mode.

If you are running a PAC Control strategy, you can use analog point commands, such as Get & Clear Analog Maximum Value, to read and reset minimum and maximum values.

PAC-R
EB
UIO
EIO
SIO
E2

Offset and Gain (Analog Points)

All memory-mapped I/O units with analog capability can calculate offset and gain for analog input points. Calculate offset first, and then calculate gain. The offset must be calculated at the point's low scale, and the gain must be calculated at the point's high scale. See page 47 for instructions.

NOTE: If you are using Modbus/TCP, you will need to calculate the offset and gain yourself. Then you can write offset and gain values to the I/O unit. See page 47 for more information.

PAC-R
EB
UIO
EIO
SIO
E2

Clamping (Analog Points)

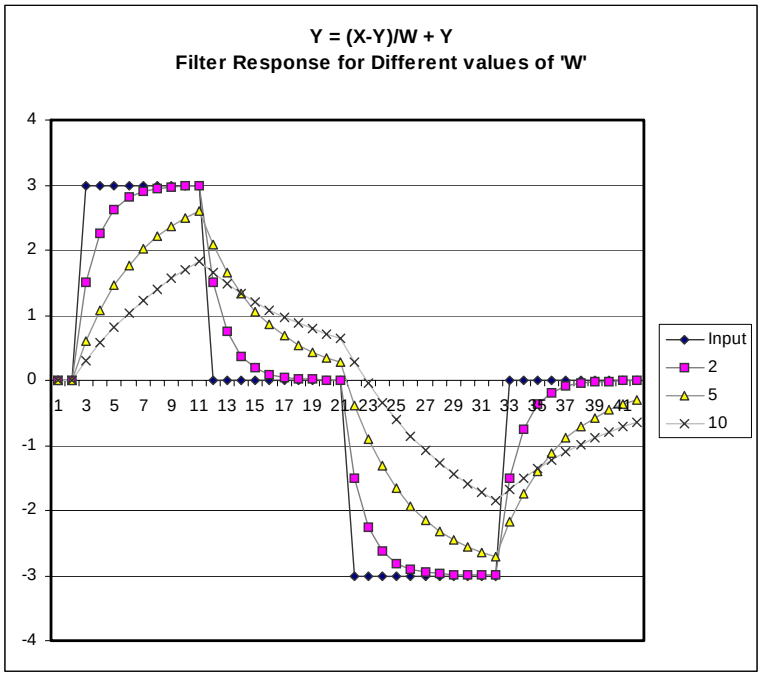
SNAP Ethernet-based I/O units with analog capability can clamp values sent to analog output points so they do not go above or below a specific limit. For example, if you are using a 0–10 VDC output module, but the device attached to one of its points can only handle a maximum of 5 VDC, you can set an upper clamp of 5 VDC for that point. The values for upper and lower clamp are set in engineering units. Use the PAC Manager Inspect window to set clamp values (see "Configuring I/O Modules, Points, and Features" on page 158).

PAC-R
EB
UIO
EIO
SIO

Average Filter Weight (Analog Points)

SNAP Ethernet-based I/O units can use a filter weight to smooth analog input signals that are erratic or change suddenly. The formula used for filtering is $Y = (X - Y)/W + Y$, where Y is the filtered value,

X is the new unfiltered value, and W is the filter weight. The following graph shows the effect of filter weights (W) 2, 5, and 10 on a step input signal:



As this graph shows, the larger the filter weight (W) you use, the smoother the analog signal.

A filter weight of zero turns off the calculation. Values less than or equal to 0.5 are changed to zero, since those values would cause an unstable signal.

Filtering is applied to values that are in engineering units, including minimum and maximum values. Filtering does not apply to values that are in counts. Set filter weight when configuring the analog point. Use the PAC Manager Inspect window to set filter weight (see "Configuring I/O Modules, Points, and Features" on page 158). If you are using PAC Control, you can also set filter weight in your control strategy using the command Set Analog Filter Weight.

Configuring Optional Functions

Introduction

Chapter 2 showed you how to configure I/O unit points and features. This chapter includes instructions for setting up the following optional functions on SNAP Ethernet-based devices:

Setting up security	page 76
Logging data	page 82
Sending event messages via email, SNMP, a stream packet, or a serial module	page 86
Using SNMP for communicating with enterprise management systems	page 90
Sending email	page 93
Using the Scratch Pad area for peer-to-peer data sharing	page 95
Streaming data	page 98
Mirroring I/O point data	page 101
Copying memory map data	page 103
Configuring Modbus options	page 106
Setting system date and time	page 111
Communicating serially with devices attached directly to a controller	page 113
Using PPP for communicating via modem with the device	page 117

In most cases, you use the same configuration file in PAC Manager to set up optional functions as you did to configure I/O units, so the complete configuration information can be uploaded all at once to SNAP Ethernet-based I/O units.

Setting Up Security

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

You can use PAC Manager to set up security for an Opto 22 SNAP Ethernet-based device. You can limit access to specific computers or other devices on the network. You can also limit access to specific protocols used with the Opto 22 device, such as SNMP (below). You can require a password for using FTP (see page 77). In addition, you can protect a PAC Control strategy so that it runs without possibility of interference from a host (page 77).

Limiting Access to Specific Computers

You can limit access to the SNAP controller or I/O unit based on the IP address of the computer or other host device attempting to communicate with it. You specify the IP addresses that may access the controller or I/O unit. Anyone on a computer or other host device with an acceptable IP address has access.

Work with your network administrator to make sure you are specifying the correct IP addresses. See "Configuring Security on an I/O Unit" on page 77 or "Configuring Security on a Standalone Controller" on page 80 for instructions.

Limiting Access to Specific Protocols

You can also limit access to specific protocols the SNAP controller or I/O unit uses. These protocols can travel simultaneously over the Ethernet/TCP/IP link and set up sessions, or ports, on the SNAP device:

- File transfer protocol (FTP), used for exchanging files between the device and a computer (applies to SNAP PAC R-series and S-series and SNAP Ultimate I/O units only)
- Modbus/TCP protocol, used by Modbus/TCP software and hardware
- OptoMMP, the IEEE 1394-based memory map protocol, used by most other tools for interfacing with the SNAP device
- Simple network management protocol (SNMP), used to communicate with SNMP-based enterprise management software (SNAP PAC, SNAP Ultimate, and SNAP Ethernet I/O units only)

For security purposes, you can hide or disable one or more of the protocols by changing the port number from its default. The following table shows the default ports.

Protocols for Default Ports:

Protocol	Used by	Default Port
FTP	PCs for file exchange	21
SNMP	enterprise management system	161
Modbus/TCP	Modbus/TCP software and hardware	502
OptoMMP	PAC Manager and most other tools	2001

Preventing Access. For example, suppose you want to prevent any device from accessing a controller using FTP. To do so, you would change the port number for the FTP protocol from the default of 21 to zero. Since zero is an invalid port, no device could access the controller using FTP.

Limiting Access. If you wanted to limit FTP access, you could change the port number from 21 to another number between 1 and 65,535. If you change the number, anyone (or any application) that needs to access the controller using FTP can do so by adding the changed port number to the controller's IP address. For example, if the controller's IP address is 10.22.56.3 and the port number is changed to 85, you would enter the following to access the controller:

```
10.22.56.3:85
```

See "Configuring Security on an I/O Unit" on page 77 or "Configuring Security on a Standalone Controller" on page 80 for instructions to limit protocol access.

Requiring a Password for FTP

You can configure security so that anyone who wants to access the device using FTP is required to enter a username and password. See instructions in "Configuring Security on an I/O Unit" on page 77 or "Configuring Security on a Standalone Controller" on page 80.

Protecting a PAC Control Strategy from Interference

You can set up a standalone or on-the-rack controller to run a stable strategy without the possibility of interference from a host. This means that no one can alter or stop the strategy using PAC Control or PAC Terminal; but it also means that PAC Display cannot communicate with the control engine.

To protect a PAC Control strategy from interference, finalize the strategy, download it, save it to flash memory, and set the autorun flag (see the *PAC Control User's Guide* for steps). Then follow steps in the next section to change the Control Engine port number from the default of 22001 to zero, and save that setting to flash as well. The strategy will automatically run when power is turned on, but a host cannot communicate with it.

If you need to change the Control Engine port number back to 22001, you can do so in PAC Manager, because PAC Manager uses the OptoMMP protocol to communicate with the controller.

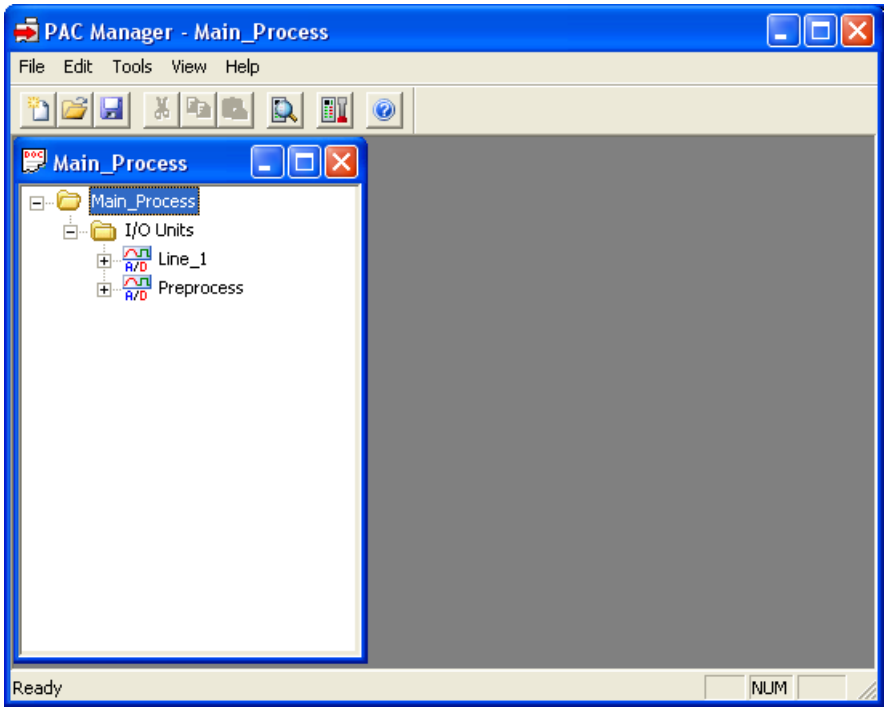
PAC-R
EB
UIO
EIO
SIO
E1
E2

Configuring Security on an I/O Unit

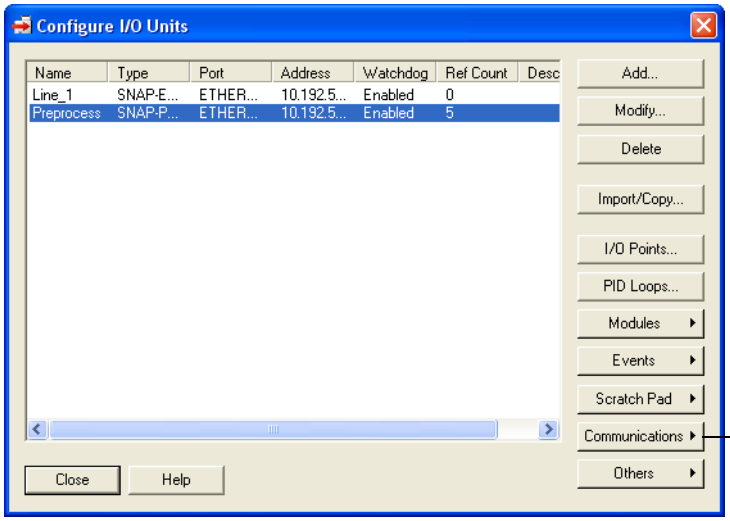
Use these steps for an I/O unit. For a SNAP PAC S-series standalone controller, use the steps on page 80.

1. In the PAC Manager main window, click the Open button or choose File→Open.

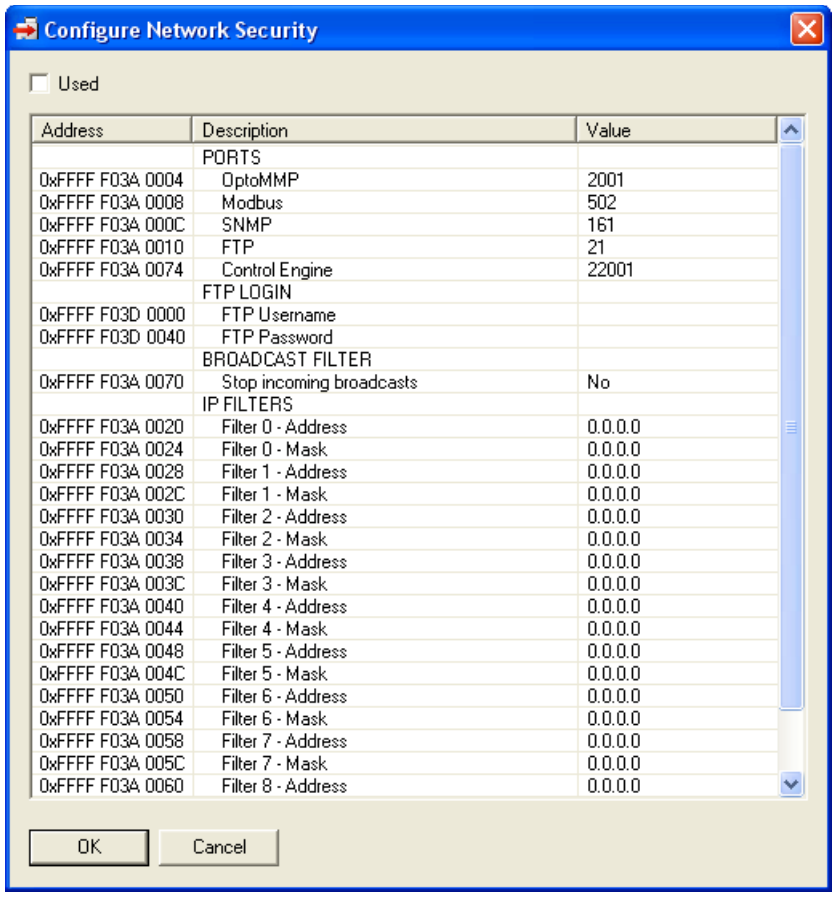
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. In the configuration tree, right-click the name of the I/O unit on which you want to set up security and choose Configure from the pop-up menu.



4. Click the Communications button and choose Network Security from the pop-up menu.


Configure Network Security
Used
Address
Description
Value
PORTS
0xFFFF F03A 0004 OptoMMP 2001
0xFFFF F03A 0008 Modbus 502
0xFFFF F03A 000C SNMP 161
0xFFFF F03A 0010 FTP 21
0xFFFF F03A 0074 Control Engine 22001
FTP LOGIN
0xFFFF F03D 0000 FTP Username
0xFFFF F03D 0040 FTP Password
BROADCAST FILTER
0xFFFF F03A 0070 Stop incoming broadcasts No
IP FILTERS
0xFFFF F03A 0020 Filter 0 - Address 0.0.0.0
0xFFFF F03A 0024 Filter 0 - Mask 0.0.0.0
0xFFFF F03A 0028 Filter 1 - Address 0.0.0.0
0xFFFF F03A 002C Filter 1 - Mask 0.0.0.0
0xFFFF F03A 0030 Filter 2 - Address 0.0.0.0
0xFFFF F03A 0034 Filter 2 - Mask 0.0.0.0
0xFFFF F03A 0038 Filter 3 - Address 0.0.0.0
0xFFFF F03A 003C Filter 3 - Mask 0.0.0.0
0xFFFF F03A 0040 Filter 4 - Address 0.0.0.0
0xFFFF F03A 0044 Filter 4 - Mask 0.0.0.0
0xFFFF F03A 0048 Filter 5 - Address 0.0.0.0
0xFFFF F03A 004C Filter 5 - Mask 0.0.0.0
0xFFFF F03A 0050 Filter 6 - Address 0.0.0.0
0xFFFF F03A 0054 Filter 6 - Mask 0.0.0.0
0xFFFF F03A 0058 Filter 7 - Address 0.0.0.0
0xFFFF F03A 005C Filter 7 - Mask 0.0.0.0
0xFFFF F03A 0060 Filter 8 - Address 0.0.0.0
OK
Cancel

5. If there is no check mark in the Used box, click the box to place a check mark there.
6. To limit access to a specific protocol, change the Port number in the Value column.

   CAUTION: *If you change the Control Engine port to zero, a strategy that is already in the control engine will still run, but PAC Display, PAC Control, and other hosts will not be able to communicate with it. See "Protecting a PAC Control Strategy from Interference" on page 77.*

7. To set up an FTP login, enter the Username and Password to be required from anyone who uses FTP to access the device.
8. To limit access to specific computers, set up to ten filter addresses and filter masks.

   The filter address is the IP address that is allowed to access the I/O unit; the filter mask indicates a range of allowed addresses. If only one IP address may access the I/O unit, enter 255.255.255.255 for the filter mask. If a range of IP addresses may access the I/O unit, enter a mask that reflects the subnet range.

   For example, if only IP address 1.2.3.4 may access the I/O unit, enter 1.2.3.4. as the filter address and 255.255.255.255 as the filter mask. If any IP address that starts with 1.2.3 may access the I/O unit, enter 1.2.3.4 (or 1.2.3.1, or any address in the range) as the filter address and 255.255.255.0 as the filter mask.

NOTE: For troubleshooting purposes, you can use the Broadcast Filter value to temporarily turn off incoming broadcasts to the I/O unit. Normally you would NOT want to do this; a BootP response, for example, is an incoming broadcast.

9. When you have finished configuring security, click OK.
10. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

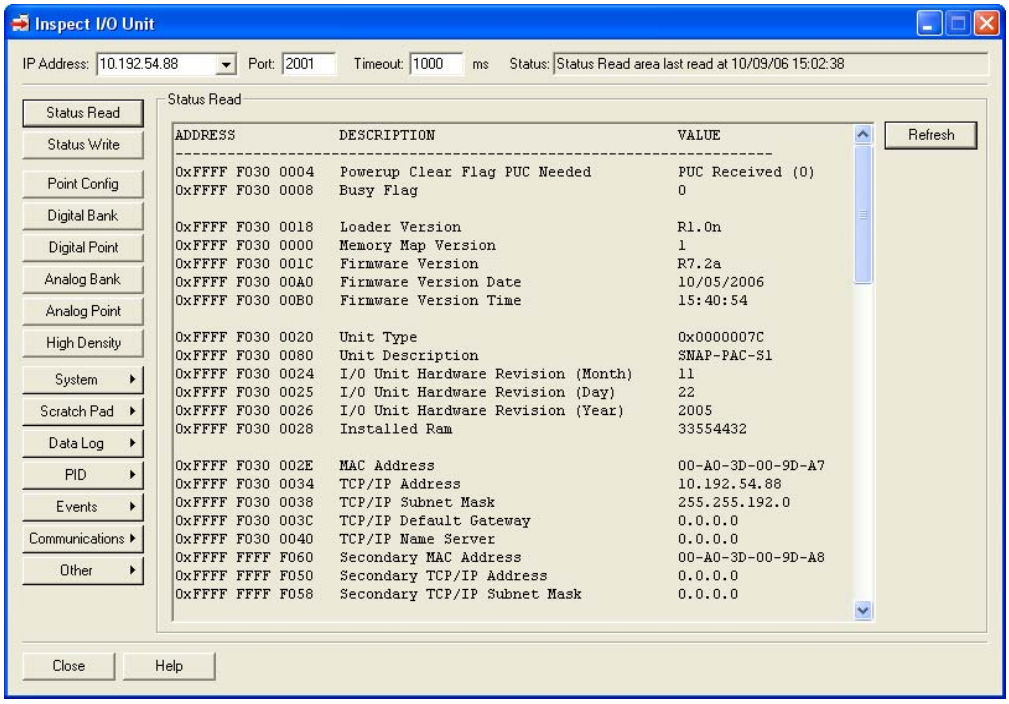
When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

PAC-S

Configuring Security on a Standalone Controller

Since this procedure sends the configuration directly to the controller, the controller must be on the same network as your PC.

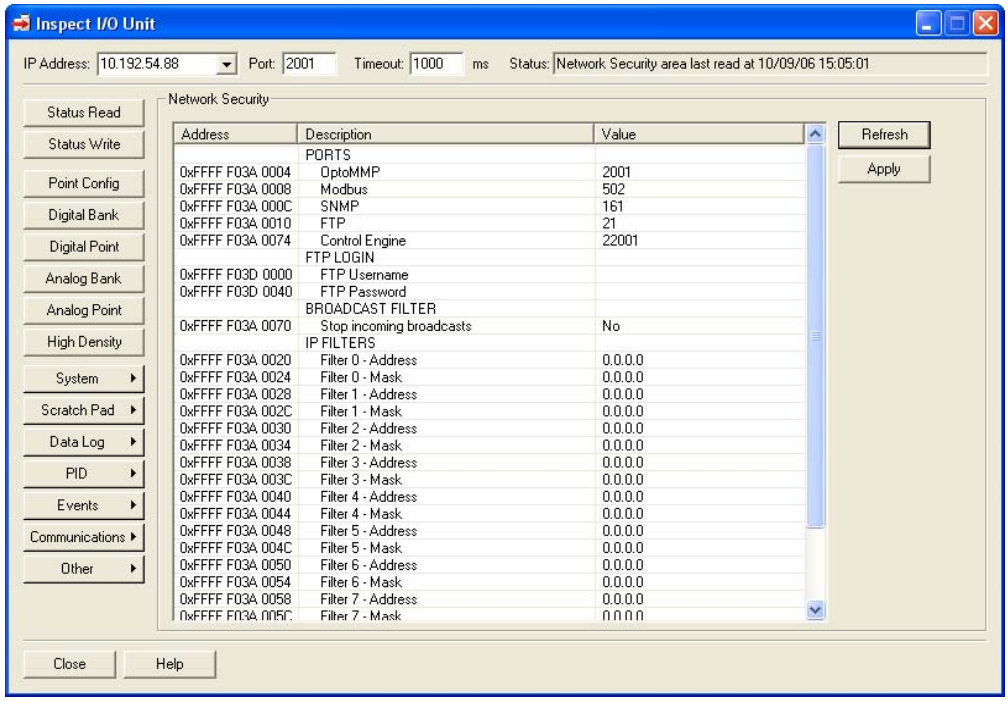
1. In the PAC Manager main window, click the Inspect button.


Inspect I/O Unit
IP Address: 10.192.54.88
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 10/09/06 15:02:38
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.0n
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R7.2a
0xFFFF F030 00A0 Firmware Version Date 10/05/2006
0xFFFF F030 00B0 Firmware Version Time 15:40:54
0xFFFF F030 0020 Unit Type 0x0000007C
0xFFFF F030 0080 Unit Description SNAP-PAC-S1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 11
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 22
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2005
0xFFFF F030 0028 Installed Ram 33554432
0xFFFF F030 002E MAC Address 00-A0-3D-00-9D-A7
0xFFFF F030 0034 TCP/IP Address 10.192.54.88
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-9D-A8
0xFFFF FFFF F050 Secondary TCP/IP Address 0.0.0.0
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 0.0.0.0
Close
Help

If you have used the Inspect button before, the last IP address you used is shown and current Status Read information from that IP address appears. The most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the controller (or choose it from the drop-down list).

3. Click Communications and choose Network Security from the submenu.


Inspect I/O Unit
IP Address: 10.192.54.88
Port: 2001
Timeout: 1000 ms
Status: Network Security area last read at 10/09/06 15:05:01
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Network Security
Address | Description | Value
PORTS
0xFFFF F03A 0004 | OptoMMP | 2001
0xFFFF F03A 0008 | Modbus | 502
0xFFFF F03A 000C | SNMP | 161
0xFFFF F03A 0010 | FTP | 21
0xFFFF F03A 0074 | Control Engine | 22001
FTP LOGIN
0xFFFF F03D 0000 | FTP Username
0xFFFF F03D 0040 | FTP Password
BROADCAST FILTER
0xFFFF F03A 0070 | Stop incoming broadcasts | No
IP FILTERS
0xFFFF F03A 0020 | Filter 0 - Address | 0.0.0.0
0xFFFF F03A 0024 | Filter 0 - Mask | 0.0.0.0
0xFFFF F03A 0028 | Filter 1 - Address | 0.0.0.0
0xFFFF F03A 002C | Filter 1 - Mask | 0.0.0.0
0xFFFF F03A 0030 | Filter 2 - Address | 0.0.0.0
0xFFFF F03A 0034 | Filter 2 - Mask | 0.0.0.0
0xFFFF F03A 0038 | Filter 3 - Address | 0.0.0.0
0xFFFF F03A 003C | Filter 3 - Mask | 0.0.0.0
0xFFFF F03A 0040 | Filter 4 - Address | 0.0.0.0
0xFFFF F03A 0044 | Filter 4 - Mask | 0.0.0.0
0xFFFF F03A 0048 | Filter 5 - Address | 0.0.0.0
0xFFFF F03A 004C | Filter 5 - Mask | 0.0.0.0
0xFFFF F03A 0050 | Filter 6 - Address | 0.0.0.0
0xFFFF F03A 0054 | Filter 6 - Mask | 0.0.0.0
0xFFFF F03A 0058 | Filter 7 - Address | 0.0.0.0
Refresh
Apply
Close
Help

4. To limit access to a specific protocol, change the Port number in the Value column.

CAUTION: *If you change the Control Engine port to zero, a strategy that is already in the control engine will still run, but PAC Display, PAC Control, and other hosts will not be able to communicate with it. See "Protecting a PAC Control Strategy from Interference" on page 77.*

5. To set up an FTP login, enter the Username and Password to be required from anyone who uses FTP to access the device.

6. To limit access to specific computers, set up to ten filter addresses and filter masks.

The filter address is the IP address that is allowed to access the controller; the filter mask indicates a range of allowed addresses. If only one IP address may access the controller, enter 255.255.255.255 for the filter mask. If a range of IP addresses may access the controller, enter a mask that reflects the subnet range.

For example, if only IP address 1.2.3.4 may access the controller, enter 1.2.3.4. as the filter address and 255.255.255.255 as the filter mask. If any IP address that starts with 1.2.3 may access the controller, enter 1.2.3.4 (or 1.2.3.1, or any address in the range) as the filter address and 255.255.255.0 as the filter mask.

NOTE: For troubleshooting purposes, you can use the Broadcast Filter value to temporarily turn off incoming broadcasts to the controller. Normally you would NOT want to do this; a BootP response, for example, is an incoming broadcast.

When all the values are correct, click Apply to send the configuration to the controller.

Logging Data from Memory Map Addresses

PAC-R
EB
UIO
EIO

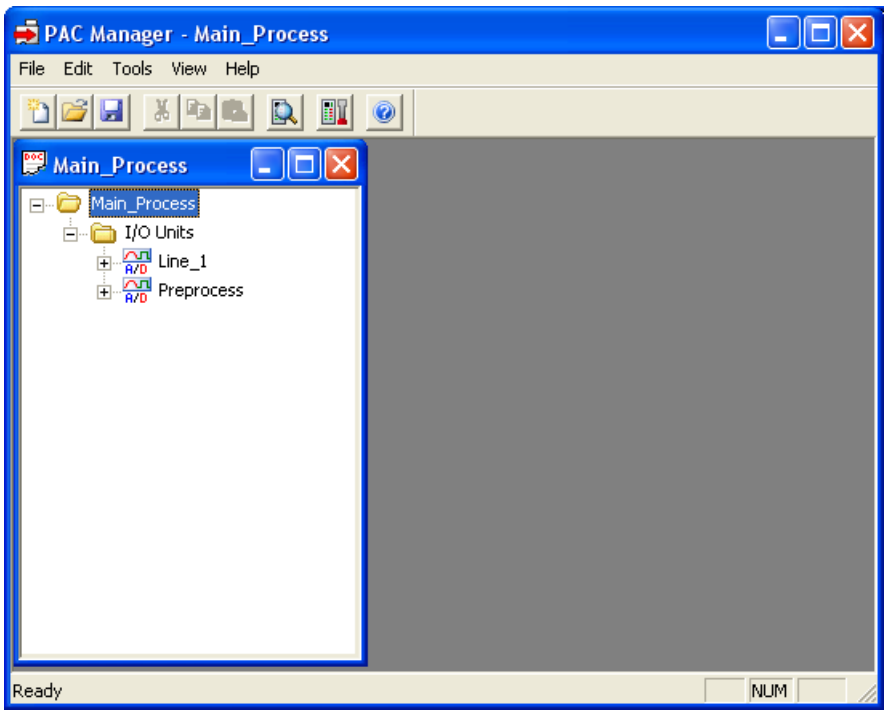
You can use a SNAP PAC R-series, SNAP Ultimate, or SNAP Ethernet I/O unit to log data from up to 64 memory map addresses. The data from all addresses goes into the same data log file, which you can view from PAC Manager. Data from this composite file can also be emailed to someone at a time interval you set. For a complete list of memory map addresses, see the *OptoMMP Protocol Guide* (form #1465).

NOTE: SNAP PAC R-series and SNAP Ultimate on-the-rack controllers have a greater memory capacity than SNAP Ethernet brains and can store multiple files for data logging or other purposes. If you are using SNAP PAC-R or SNAP Ultimate, especially with PAC Control, you may prefer to log data in a different way. See page 202 and the PAC Control User's Guide *for more information about the controller's file system.*

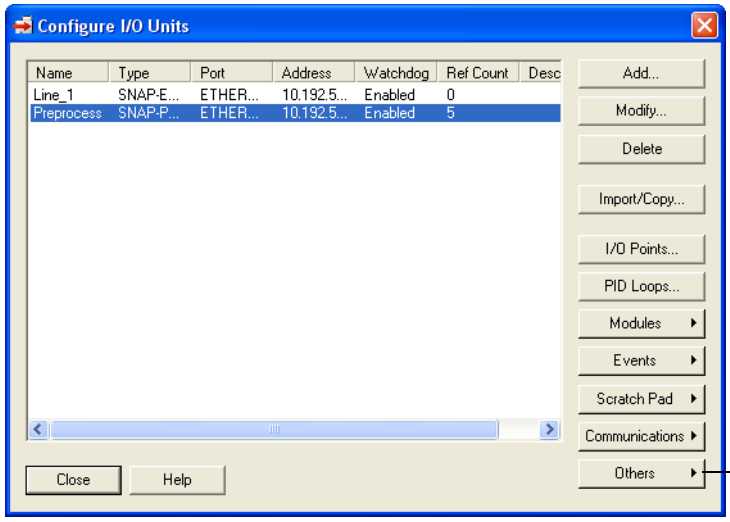
Note that SNAP PAC and SNAP Ethernet brains cannot save logged data if power to the unit is cycled.

Configuring Data Logging

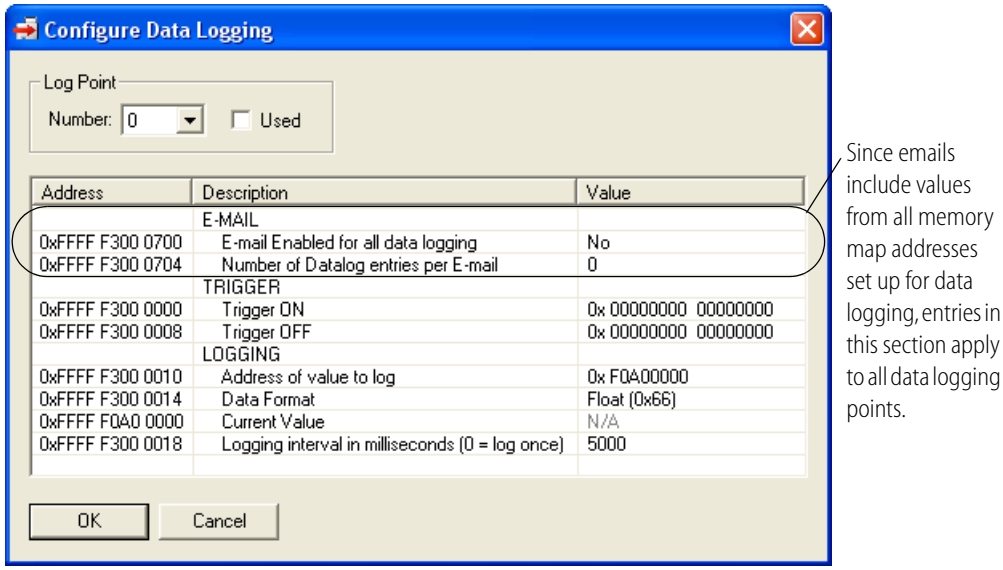
1. In the PAC Manager main window, click the Open button or choose File→Open.
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. In the configuration tree, right-click the name of the I/O unit on which you want to set up data logging and choose Configure from the pop-up menu.



4. Click the Others button and choose Data Logging from the pop-up menu.



5. Choose the lowest empty Log Point number from the drop-down list and click to put a check mark in the Used box.

NOTE: To reduce scanning time, the I/O unit stops scanning log points when it reaches an unused data logging number. Make sure you use these numbers in order, starting with the lowest.

6. To have the data log emailed, click the Value column cell and enable email. Also enter the number of data entries in the log you want each email message to contain.

A maximum of 140 log entries can go in each email. Remember that email applies to all points that are logged, since all the data goes into one file.

7. In the Value column, click the cell and then enter the Scratch Pad On mask and Off mask to trigger this data log point. Also enter the memory map address of the data you want to log and choose the format of data in that address. Finally, enter how often data should be logged for this address, in milliseconds (to log data just once, enter 0).
8. When all values are correct, click OK. Repeat from step 5 for additional log points.
9. Remember to also configure email to indicate where the data log should be sent. See page 93.
10. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

IMPORTANT: *If you have changed the data logging interval, you must save the configuration file to flash memory and restart the I/O unit for the configuration to take effect.*

When you are ready to upload the configuration file to the I/O unit, see page 67.

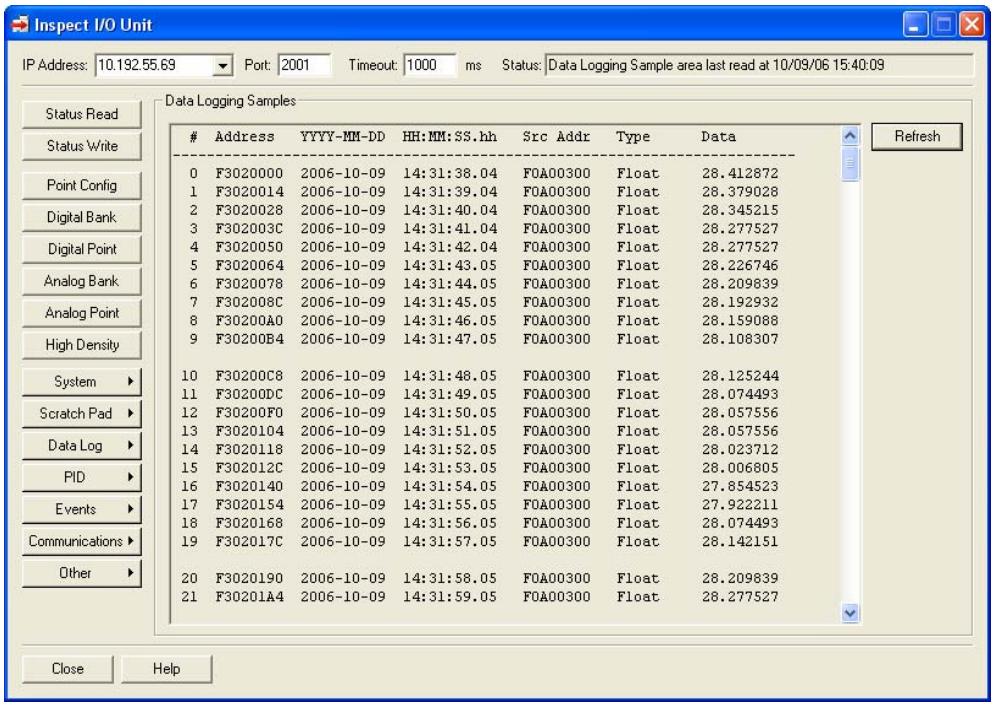
PAC-R
EB
UIO
EIO

Reading the Data Log

The data log is a single file that records data from all the memory map addresses you have configured to log data from (see steps starting on page 82). The data from up to 64 memory map addresses can be logged, and all logged data is recorded in one file. The log file holds up to 300 lines of data; when it is filled, new entries replace the oldest ones.

This composite log file can be viewed through PAC Manager and can be emailed to someone at regular intervals you set. Each line in the log file consists of the date and time stamp, the memory map address the data is coming from, the type of data, and the data itself.

1. To view logged data, click the Inspect button in the PAC Manager main window.
2. In the IP Address field, type the IP address of the I/O unit or choose it from the drop-down list. Click Data Log and choose Data Logging Samples from the pop-up menu.



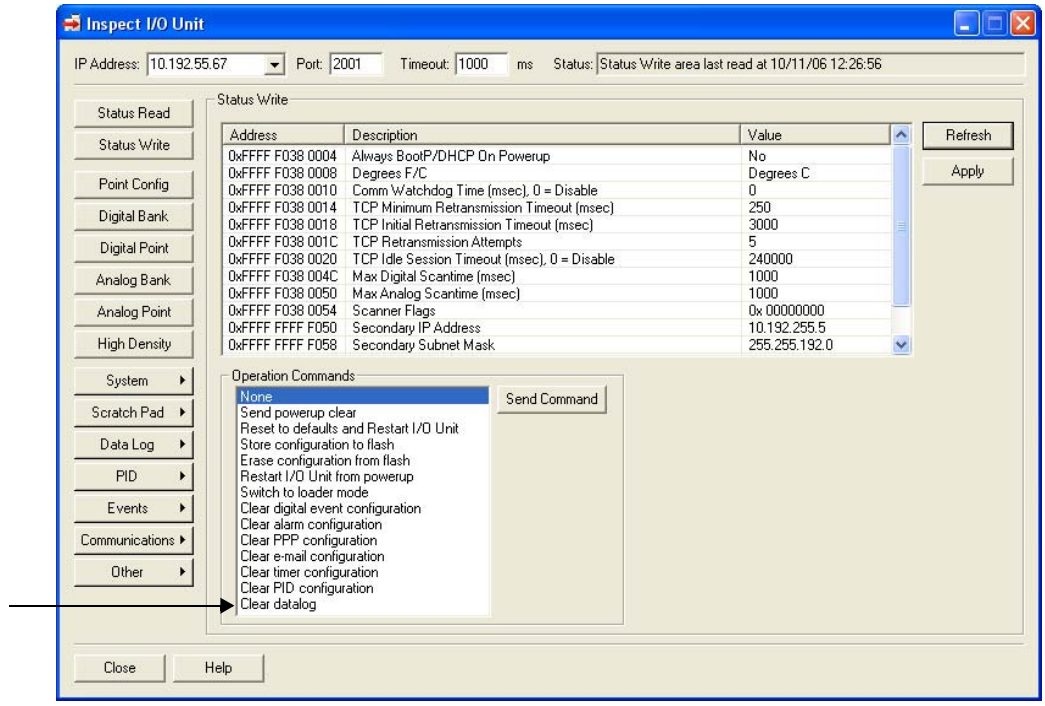
The log includes the following information:

Column	Notes
Address	Address of the data item within the data log itself. Data is logged in memory map addresses F3020000–F302175C. Each data item takes 20 bytes.
YYYY-MM-DD	Date the data was logged
HH:MM:SS.hh	Time the data was logged
Src Addr	Memory map address the data came from
Type	Format of the data
Data	Data from the memory map address. NOTE: -nan means “not a number” and indicates that data is not in the form of an IEEE float.

PAC-REB UIO EIO

Clearing All Data from the Log

1. In the PAC Manager main window, click the Inspect button .
2. In the IP Address field, type the IP address of the I/O unit or choose it from the drop-down list. Click Status Write.



3. In the Operation Commands list, click to highlight Clear datalog. Click Send Command.

   The data log is cleared and a Success message appears.

Configuring Event Messages

PAC-S
PAC-R
EB
UIO
EIO

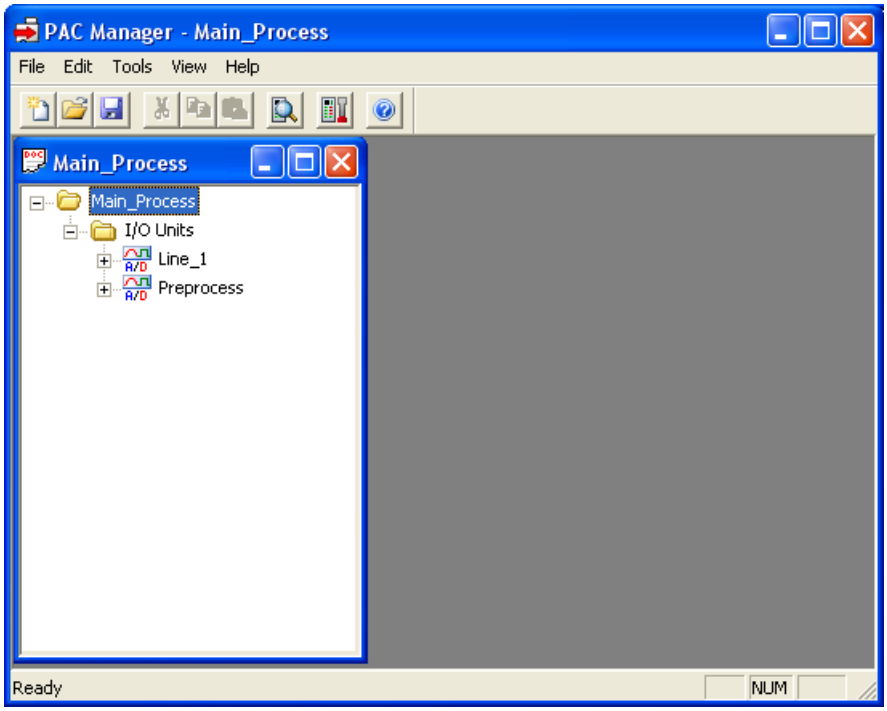
You may need to send a message—via email, data streaming, SNMP, or a serial module—from an I/O unit or a controller when a specific event occurs. For example, you could send a message if a digital point is on, if an analog point reaches a certain value, if a specific string is received through a serial module, or if a variable contains a specific value. You can send one type of message or more.

NOTE: You must be using a PAC Control strategy to configure event messages in this way. In the PAC Control strategy, your flowchart monitors the event and triggers the message using the command Set Event Message State. Messages must be configured before they can be used in PAC Control.

If you are NOT using a PAC Control strategy, you cannot configure event messages in a configuration file. You must configure them using Inspect mode. See page 140.

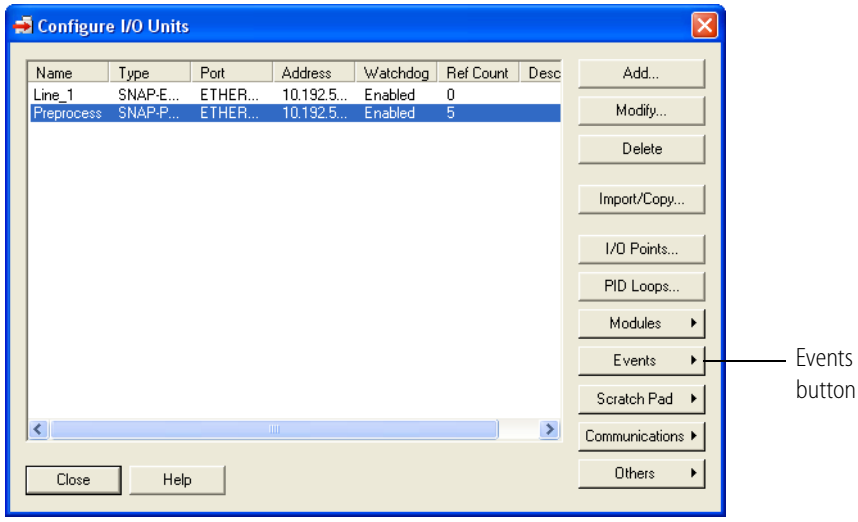
Follow these steps to configure up to 128 event messages for use with a PAC Control strategy.

1. In the PAC Manager main window, click the Open button or choose File→Open.
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.

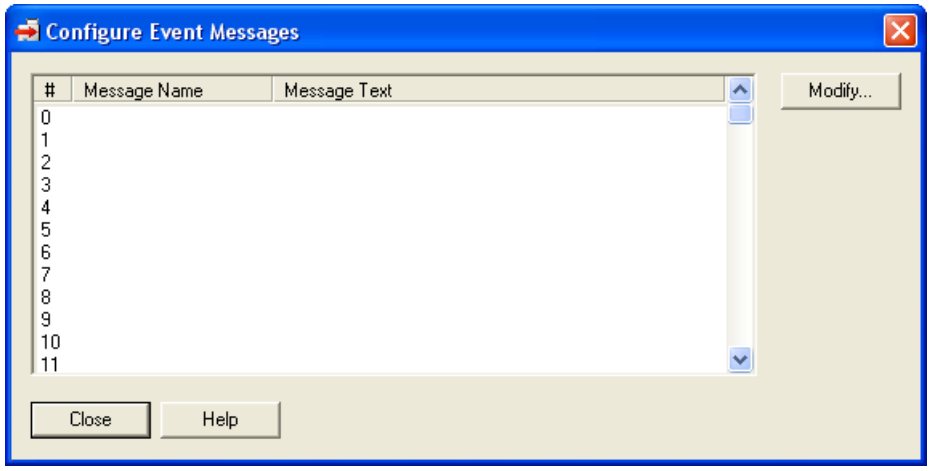


3. In the configuration tree, right-click the name of the I/O unit on which you want to set up event messages and choose Configure from the pop-up menu.

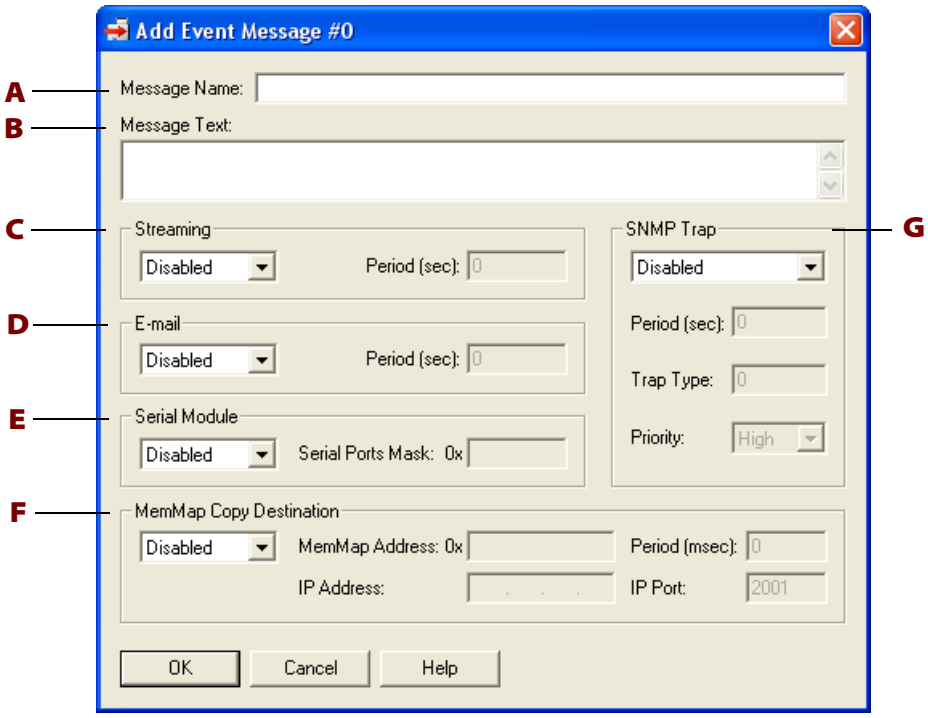
For a SNAP PAC S-series controller, if it does not already appear in the list, add it as an I/O unit of the type Generic OptoMMP Device.



4. Click the Events button and choose Event Messages from the pop-up menu.



5. Highlight an empty message number in the list and click Modify.



6. Complete the fields as follows:

A Enter a name for the message.

B For an email or serial message, and optionally for an SNMP message, enter the message text. Message text is not sent in the streaming packet.

Message text is limited to 127 characters. You can place data from the I/O unit's memory map into the message by using a plugin (see page 89). If you are sending a serial message, make sure the text is formatted so the serial device that receives it will understand it.

C To send a stream of data as the message, choose Enabled from the drop-down list. Enter how often in seconds to send the stream (0 sends it only once).

D To send an email message, choose Enabled from the drop-down list. Enter how often in seconds to send the email (0 sends it only once).

E To send a message through a serial module to a serial device, choose Enabled from the drop-down list. Enter a mask representing the modules and ports to receive the message.

F To copy memory map data, see page 103.

G To send an SNMP trap as the message, choose Enabled from the drop-down list. Enter how often to send the trap (0 sends it only once). Also enter the trap type (determined by your SNMP management software). If you are using SNMP with outgoing PPP and want the trap stored in the I/O unit until the next communication, set Priority to Low. If you want the I/O unit to immediately dial out and send the trap, set Priority to High.

NOTE: SNMP messages must be acknowledged. If the Period is set to more than zero, the alarm will continue to be sent until the trap is acknowledged and the Scratch Pad trigger is reset to zero.

In PAC Control, you can use the command Set I/O Unit Event Message State to build the acknowledgment into the flowchart logic.

In PAC Manager, you can acknowledge the trap and reset the Scratch Pad by using Inspect →Events →Event Messages (change State to Acknowledged and reset Scratch Pad bits).

7. When all fields are correct, click OK.
8. When you have configured all event messages, click Close.
9. For each type of message you configure, make sure you also set up basic configuration:

   Streaming: page 98 Serial: page 48
   Email: page 93 SNMP: page 90

10. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Using Plugins

PAC-R EB UIO EIO

Several plugins are available for use in event messages and memory map copying. The following table guides you in using them.

To do this	Use this plugin	In these places	See
Include the pattern string from a serial communication module.	`$!_str_`	Serial messages	page 86
Show which serial port sent the pattern string.	`$!_port_`	Serial messages	page 86
Include data from a memory map address. X = type of data (S=string, D=integer, F=float, P=IP address, B=4 binary bytes) YYYYYYYY = memory map address (see examples below)	`$!X_YYYYYYYY_`	Event messages Memory map copying	page 86 page 103
Number emails with a sequence ID	`$!_seqid_`	Email messages	page 86
Turn digital points on or off using a bit mask	`&#x00000000_`	Memory map copying	page 103

NOTE: For email messages, message text including plugins must be 127 bytes (characters) or less. The message length after all plugins have been expanded into their data values must be 255 bytes or less.

Examples: Including Data from Memory Map Addresses

See the appendix in the *OptoMMP Protocol Guide* for the complete list of memory map addresses. Here are a couple of examples:

To include the on/off state of a switch on module 0, point 3, you would put this in the message:

```
$!D_F08000C0_
```

To include the temperature of an ICTD input on module 4, point 0, you would use:

```
$!F_F0A00400_
```

Sending Binary Data in Event Messages

To send binary data in the text of an event message, begin with `&#x` and end with `_`. You can include any number of ASCII hex digits up to the 127-byte limit for the message field. You can also include multiple &#x plugins. This plugin is resolved after all other plugins have been resolved, and only just before sending the contents of the message field out of the specified serial ports. Examples:

To include an embedded null (one binary character):

```
&#x00_
```

To include a number of binary characters:

```
&#x0a0dCF0034_
```

Configuring SNMP

PAC-S
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The Simple Network Management Protocol (SNMP) is used to communicate with an SNMP-based enterprise management system, such as Computer Associates' Unicenter®, Hewlett-Packard's OpenView®, or IBM's Tivoli®. These enterprise management systems can manage analog, digital, or serial devices through a SNAP PAC controller or SNAP PAC, SNAP Ultimate, or SNAP Ethernet I/O unit just as they manage computer equipment on the Ethernet network.

SNMP Traps

You can set up the controller or I/O unit to send messages to the management system in the form of SNMP traps. The device can send three kinds of traps:

- Authentication trap—sent when a host requests data that is outside its access permissions
- Cold start trap—sent whenever the I/O unit is turned on
- Exception trap—sent in reaction to an event; an exception trap is a type of event message.

Authentication and cold start traps can be enabled using the steps in this section. To configure exception traps, see "Configuring Event Messages" on page 86.

SNMP Access Privileges

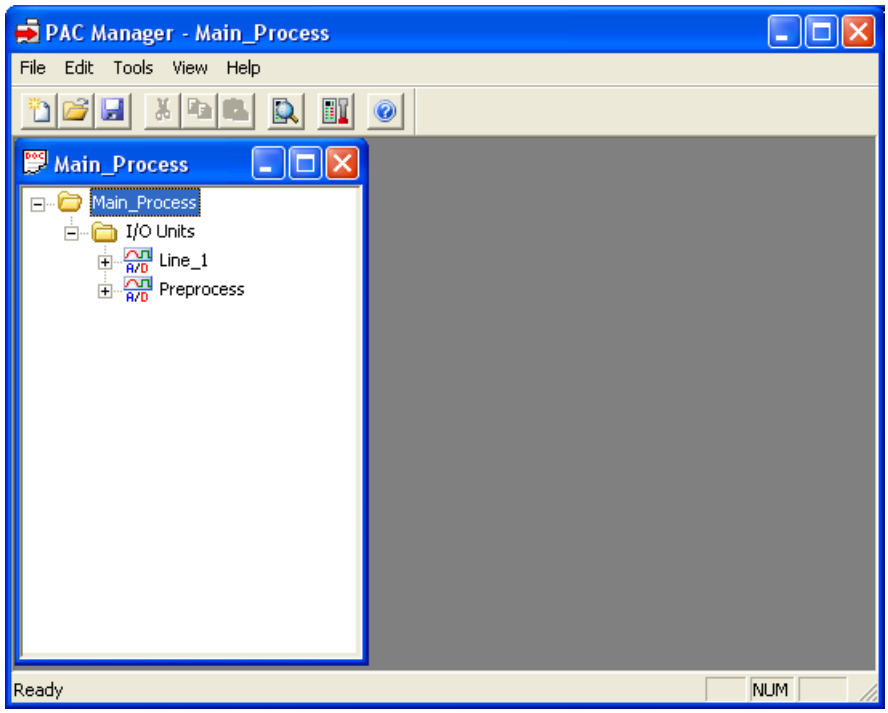
Community groups control access to SNMP information from the controller or I/O unit. When you set up a community group, you determine its privileges to read, write to, and receive traps from the system.

In order to receive traps, a host must be a registered *management host* and be part of a community group that has access privileges for traps. Once a registered management host becomes part of a community group, that group is no longer available to non-registered hosts. It includes only the hosts registered to it.

To set up community groups, follow the steps in this section. You can define up to eight community groups.

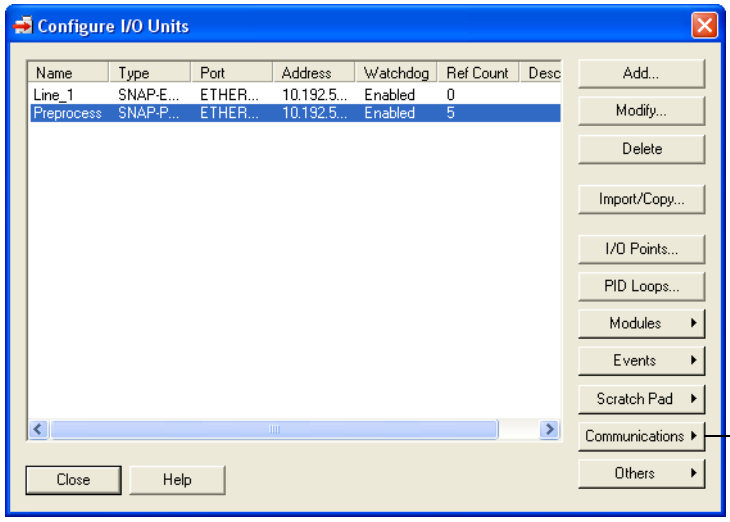
Configuring the SNMP Agent

1. In the PAC Manager main window, click the Open button or choose File→Open.
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.

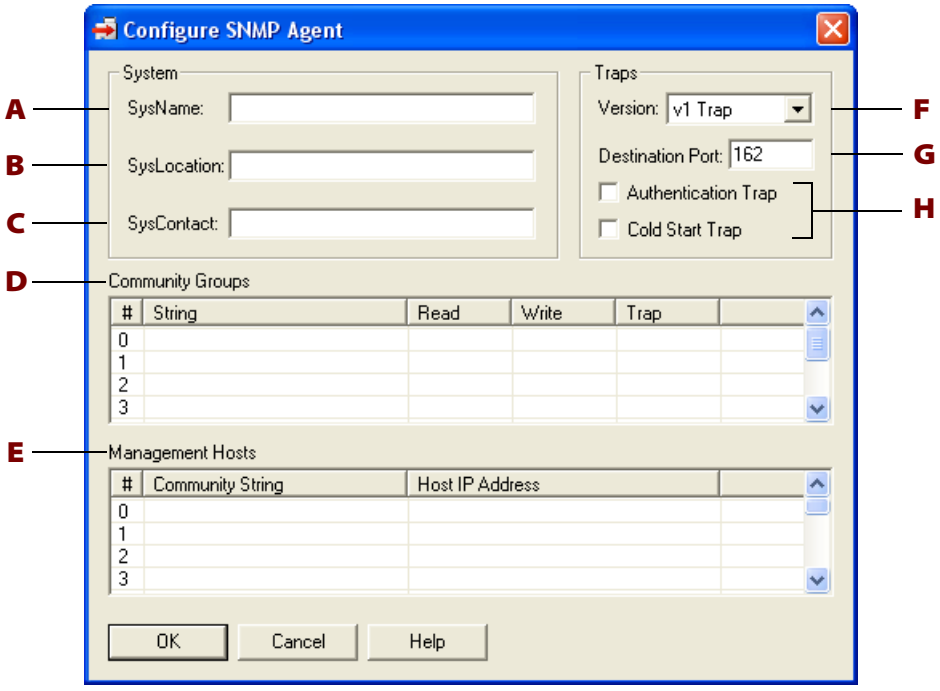


3. In the configuration tree, right-click the name of the I/O unit on which you want to set up SNMP and choose Configure from the pop-up menu.

   For a SNAP PAC S-series controller, if it does not already appear in the list, add it as an I/O unit of the type Generic OptoMMP Device.



4. Make sure the correct I/O unit is highlighted in the list. Click the Communications button and choose SNMP from the pop-up menu.



5. Complete the fields as follows:
   - **A** Enter the name assigned to the I/O unit as a managed node within the SNMP management system.
   - **B** Enter the physical location of the I/O unit.
   - **C** Enter the ID of the contact person for the I/O unit.
   - **D** To set up the Community Groups you need, highlight a line in the list. Click the String cell within the line and type the name of the group. Then click in the Read, Write, and Trap cells and choose Yes or No from the drop-down list to indicate whether that group has privileges to read, write, and receive traps.
   - **E** To set up Management Hosts, highlight a line in the list. Start with hosts on the local network first, because the system sends messages to hosts in numeric order, and it stops sending messages when it finds a host that it cannot connect to. Click the Community String cell and enter the name of the community group the host belongs to. Click the Host IP Address cell and enter its IP address, including the dots (for example, `10.192.55.60`).
   - **F** (All I/O units except SNAP Simple and SNAP Ethernet) From the drop-down list, choose the version of SNMP you are using.
   - **G** 161 is the default port for SNMP communications. If you know that your application will use a different port, enter the number of that port here.
   - **H** To enable authentication or cold start traps, click the box to check it.
6. When all fields are correct, click OK.

IMPORTANT: *For the configuration to take effect, you must upload the configuration file to the I/O unit, save it to flash memory, and restart the I/O unit.*

7. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Configuring Email

PAC-S
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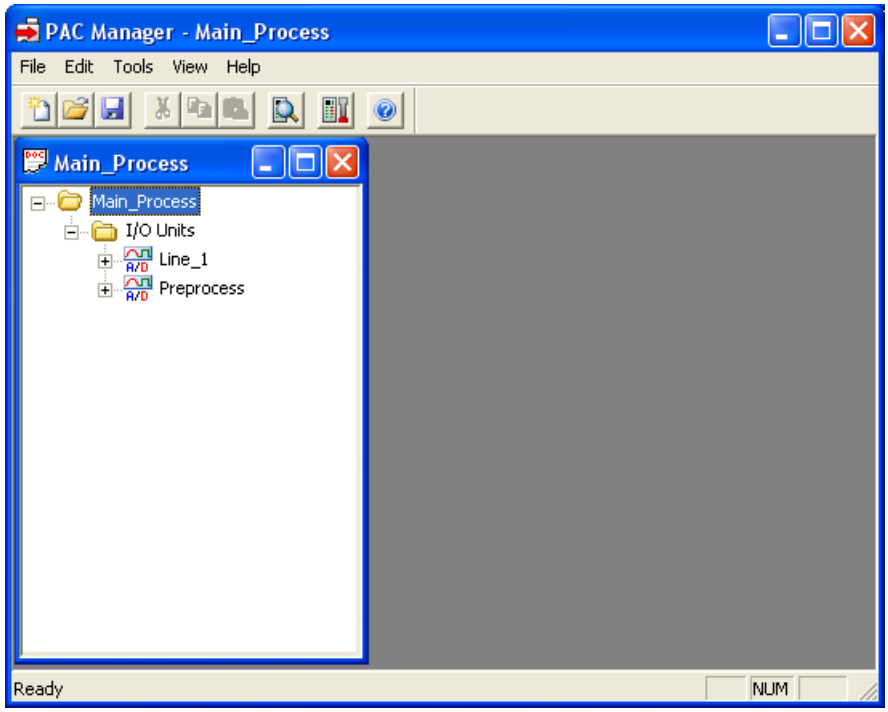
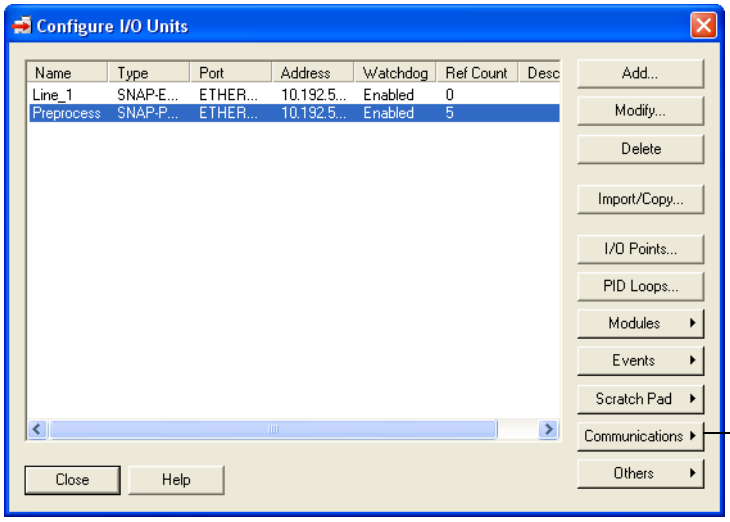
You can send an email message or page someone in response to an event. Follow the steps in this section to set up email parameters. See "Configuring Event Messages" on page 86 to set up the message itself.

1. In the PAC Manager main window, click the Open button or choose File→Open.
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.

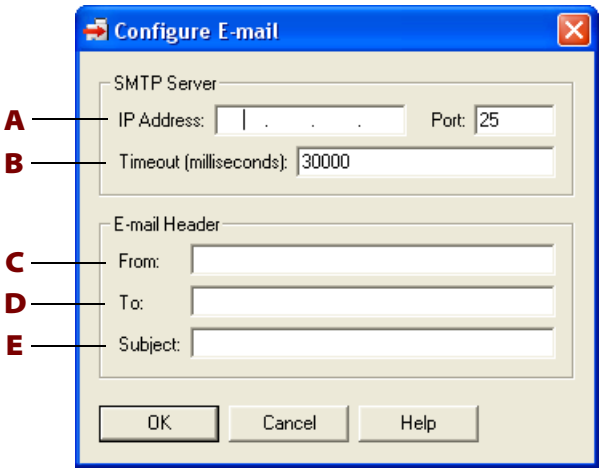


3. In the configuration tree, right-click the name of the I/O unit on which you want to set up email and choose Configure from the pop-up menu.

For a SNAP PAC S-series controller, if it does not already appear in the list, add it as an I/O unit of the type Generic OptoMMP Device.



4. Make sure the correct I/O unit is highlighted in the list. Click the Communications button and choose E-mail from the pop-up menu.



5. Complete the fields as follows:

- **A** Enter the IP address and port number of the Simple Mail Transfer Protocol (SMTP) server the I/O unit will use to send email. You should be able to get this information from your network administrator.
- **B** Enter the length of time in milliseconds the I/O unit should wait for a response from the email server. The default is 30,000.
- **C** Enter a valid email address that will identify the I/O unit to the person who receives the email.
- **D** Enter the email address of the person who will receive the email.

E Enter a phrase that will indicate the purpose of the email to the person receiving it. Note that this subject line applies to all email messages sent by this I/O unit. Plugins can be used in this field. For example, if a similar email will be sent at intervals (such as an email of the data log), you can use the *seqid* plugin to put a sequence number at the end of each subject line. This plugin is in the format:

```
$!_seqid_
```

So, for example, if you enter `Process Data Log $!_seqid_` in the subject field, the first email message will have a subject line of `Process Data Log 0`, the next message will have a subject line of `Process Data Log 1`, and so on. For information on other plugins, see "Using Plugins" on page 89.

6. When all fields are correct, click OK.

IMPORTANT: *For the configuration to take effect, you must upload the configuration file to the I/O unit, save it to flash memory, and restart the I/O unit.*

7. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Setting Up Initial Values in the Scratch Pad Area

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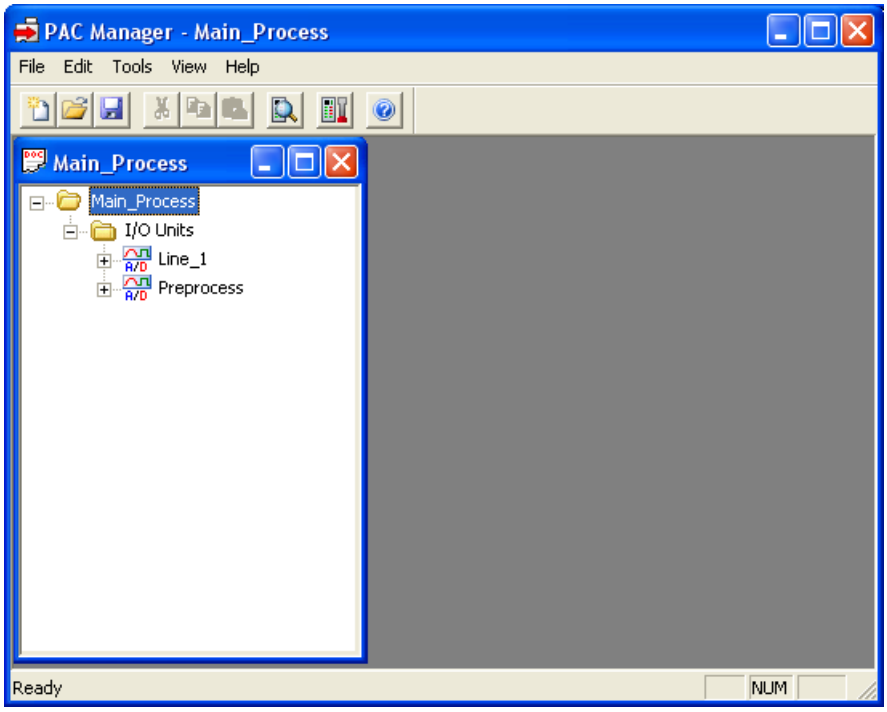
Before you use this section, read "Event/Reaction Concepts" on page 124.

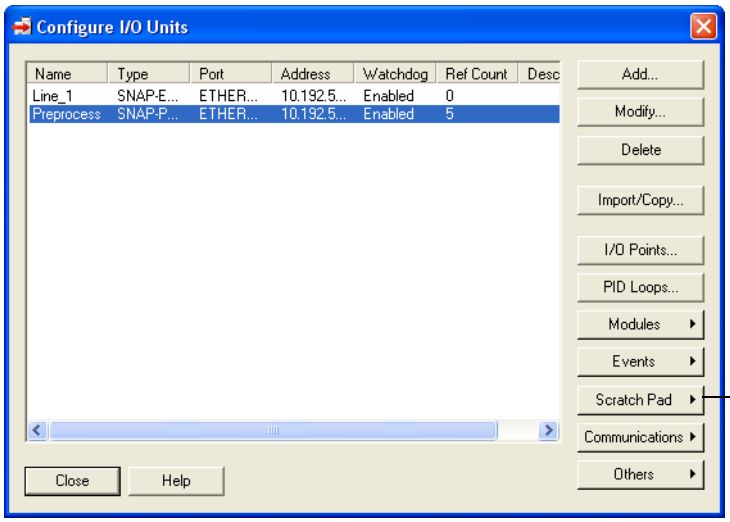
To set initial Scratch Pad values and save them as part of the configuration file, follow these steps. (To see Scratch Pad values or change them in real time, see "Reading and Writing to the Scratch Pad Area" on page 180.)

1. In the PAC Manager main window, click the Open button or choose File→Open.

2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. If you are using a SNAP PAC S-series controller, configure an I/O unit to represent the controller for Scratch Pad purposes. Configure this I/O unit as a Generic OptoMMP Device, using the IP address for the controller. (Do not add any points or configure other features.)
4. In the configuration tree, right-click the name of the I/O unit on which you want to configure the Scratch Pad and choose Configure from the pop-up menu.



5. Make sure the correct I/O unit is highlighted in the list. Click the Scratch Pad button and choose Bits, Integers, Floats, or Strings from the pop-up menu.

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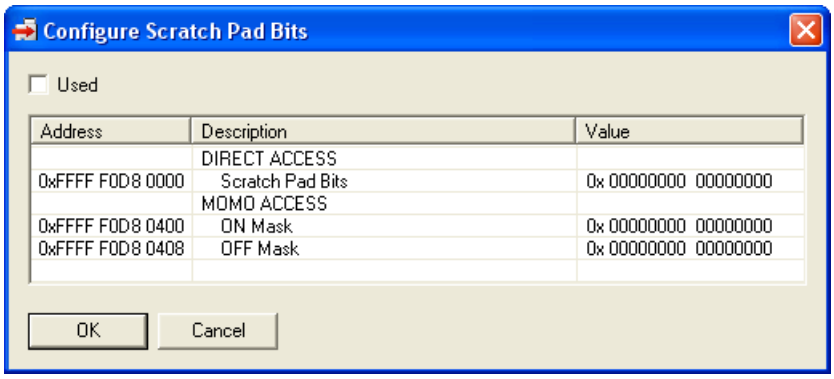
Scratch Pad Bits



1. Click to put a check mark in the Used box.
2. Click the cell in the Value column to set initial values for either the bits in the Direct Access area or the MOMO masks in the MOMO Access area.
3. Click OK.

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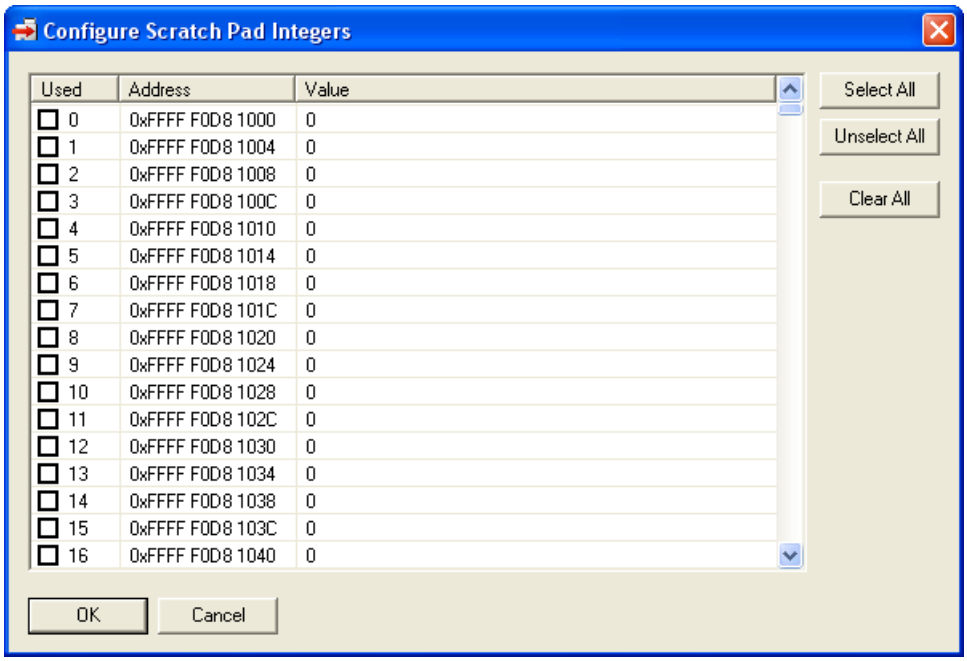
Scratch Pad Integers, Floats, or Strings

The Configure Scratch Pad Integers dialog box is shown as an example. The dialog boxes for strings and floats are similar.



1. For each integer you want to use, click to put a check mark in its box in the Used column. Click the cell in the Value column and enter the initial value.
2. Repeat for each integer. When all integers have been set, click OK.

Configuring Streaming

PAC-R EB UIO EIO SIO

Most communication involves the two-step process of request and response. A faster way of getting information from the I/O unit, however, is by streaming data. Streaming does not use TCP/IP; it uses the User Datagram Protocol (UDP/IP) instead.

NOTE: Because Modbus/TCP runs on TCP, not UDP, streaming data via Modbus/TCP is not possible. However, you can stream to a non-Modbus host at the same time you are using the Modbus/TCP protocol for another purpose.

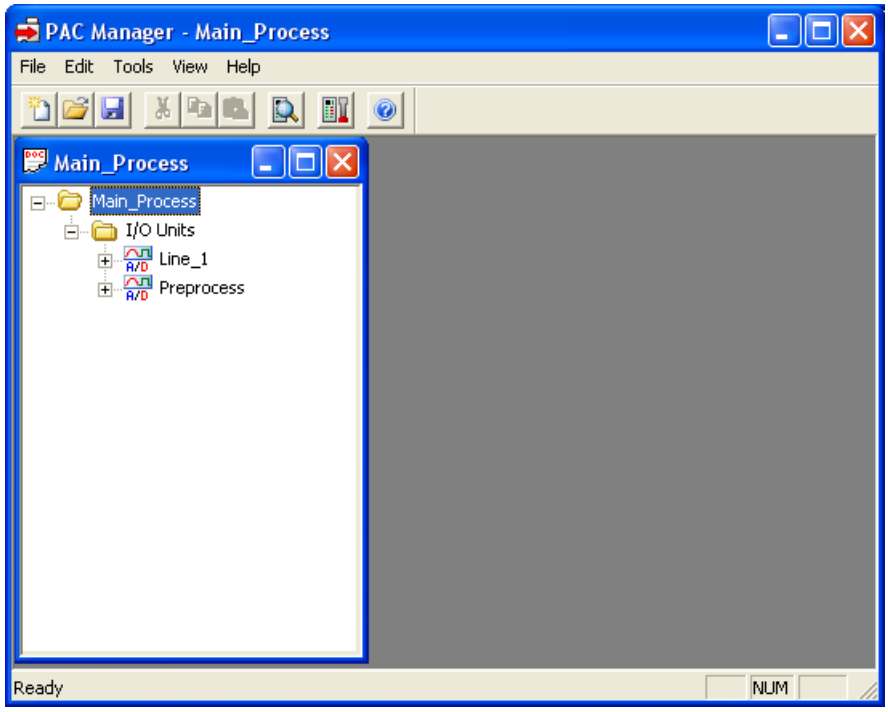
Streaming is a fast way to get continuous data from the I/O unit and is ideal for data acquisition applications. When it streams, the system sends data at regular intervals to specified IP addresses. You set up the interval, the IP addresses to receive the data, and (optionally) the port number. The system sends the data at the specified interval. The communication is one-way; the system does not wait for a response.

CAUTION: *If you stream to multiple IP addresses, and one or more of the streaming targets is either offline or not running the application that receives the stream, delays may occur. If a target is offline, the I/O system will stop streaming while it tries to resolve the IP address. If the application is not running on the PC that receives the stream, the PC will send the I/O system an error message; if the stream occurs frequently, the additional error messages can slow down the network.*

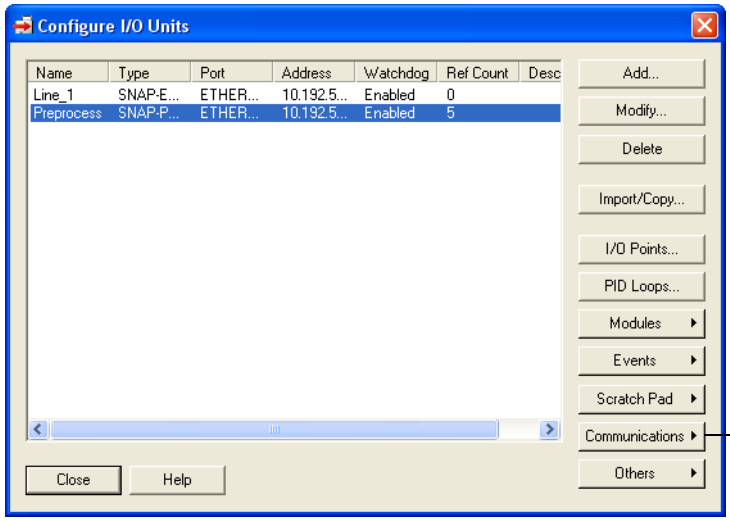
Streaming involves two steps: setting up parameters on the I/O unit for streaming, and receiving data in your application. Follow the steps in this section to set up the parameters. For information on receiving data in your application, see the *OptoMMP Protocol Guide*.

1. In the PAC Manager main window, click the Open button or choose File→Open.

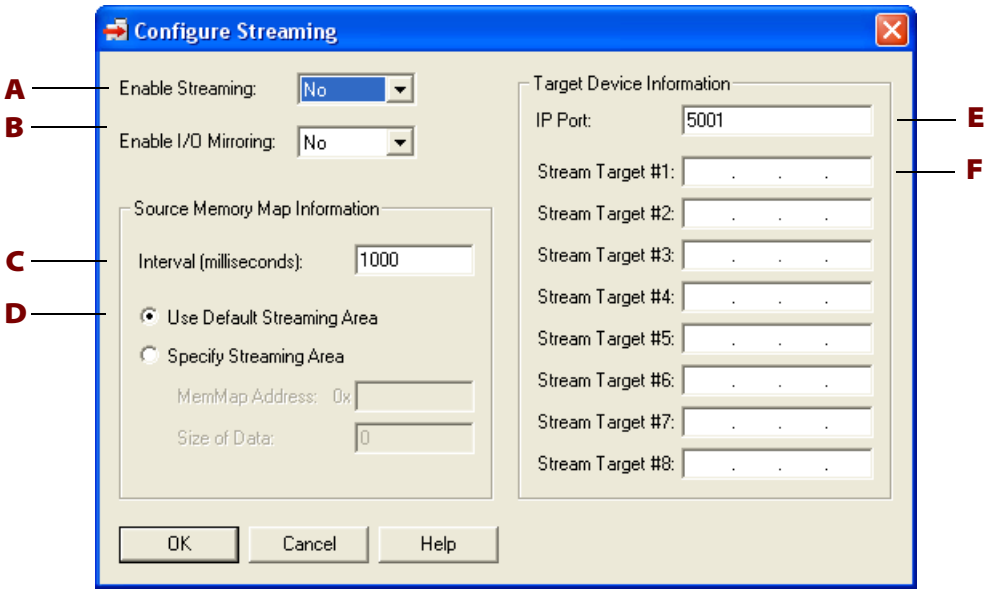
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. In the configuration tree, right-click the name of the I/O unit on which you want to set up streaming and choose Configure from the pop-up menu.



4. Make sure the correct I/O unit is highlighted in the list. Click the Communications button and choose Streaming from the pop-up menu.



5. Complete the fields as follows:
   - **A** To enable streaming, choose Yes from the drop-down list.
   - **B** I/O mirroring is a separate function. It's generally not a good idea to use both streaming and mirroring on the same I/O unit. See "Mirroring I/O Point Data" on page 101 for more information.
   - **C** Enter how often in milliseconds you want the I/O unit to send the streamed data. If you are configuring streaming to use only as an event message, set the streaming interval to 0. Zero means that the stream will be sent only once.
   - **D** To stream all addresses in the Streaming section of the I/O unit's memory map, click Use Default Streaming Area. See the memory map appendix in the *OptoMMP Protocol Guide* for more information. (Note that the Streaming section does not include data from high-density digital modules.)

     To stream only part of the Streaming section, or to stream a different part of the memory map, click Specify Streaming Area. Enter the starting address in the Memory Map Address field (the address must be entered in hex), and enter the size in bytes of the data to stream in the Size Of Data field.
   - **E** Enter the IP port on the PCs or devices that receive the streamed data. Your application must refer to this port number. Use the default of 5001 unless you know it is already being used for another purpose.
   - **F** Enter the IP addresses of up to eight devices to receive the streamed data.
6. When all fields are correct, click OK.
7. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Mirroring I/O Point Data

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EIO

Mirroring I/O point data is a way to automatically change all the points on one I/O unit to match all the points on another I/O unit. A simple example of mirroring is controlling whether lights in one facility are on or off by having them mirror the on or off status of switches in another facility.

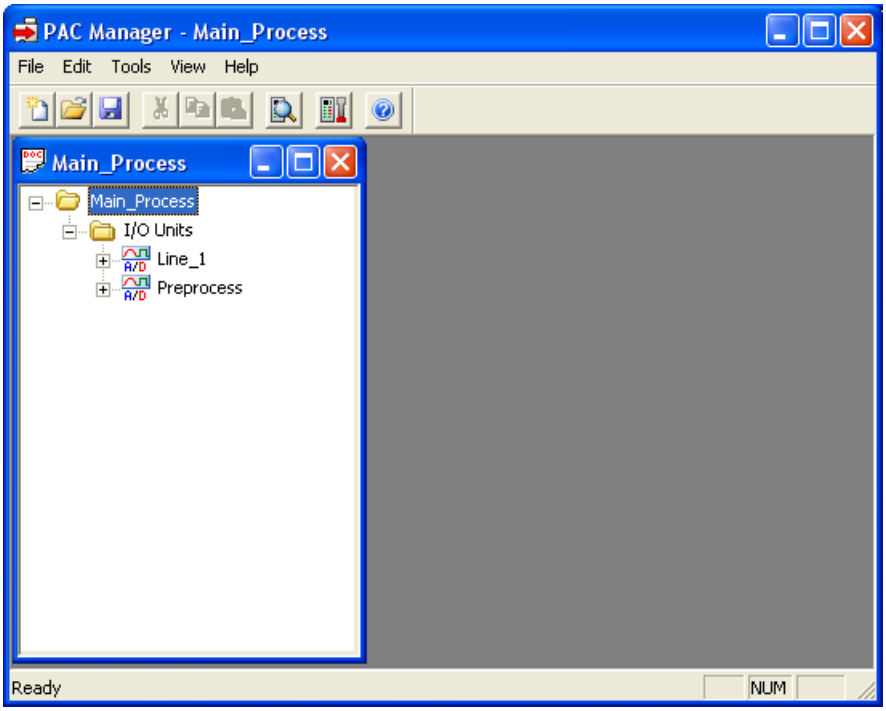
Mirroring reads the current analog bank values (in Engineering Units) and the current digital bank status (4-channel digital modules only, not high-density digital modules) of the points on a system and writes the data to the same point numbers on a second system. The reading and writing occurs as often as you specify. In our lighting system example, the status of switches in Facility A could be read every minute and automatically written to the lights in Facility B. When someone turns on the switches in Facility A, the lights in Facility B would automatically be turned on within a minute.

It's generally not a good idea to use both mirroring and streaming on the same I/O unit. If you do use both, streaming target #1 will receive both mirroring and streaming packets; the streaming packets are ignored, but they unnecessarily add to network traffic.

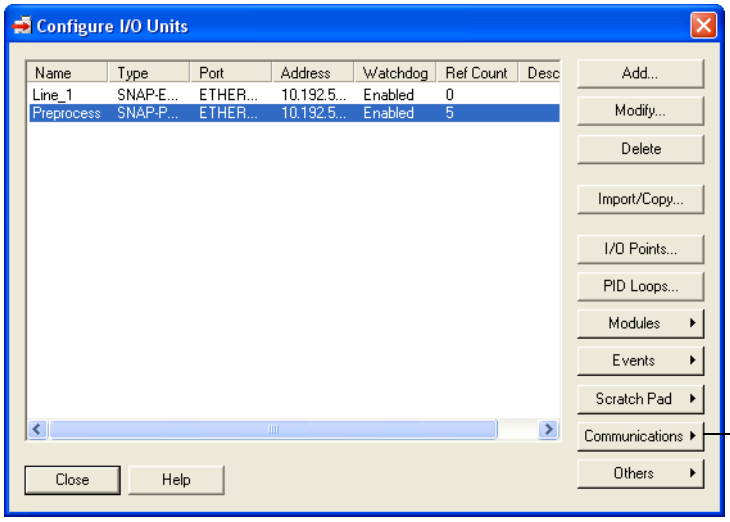
NOTE: Due to the size limit of the mirroring packet, mirroring for digital points occurs on the first 32 points of the I/O unit only (points on the modules in positions 0–7). Mirroring cannot be used with high-density digital modules.

Follow these steps to set up I/O point data mirroring:

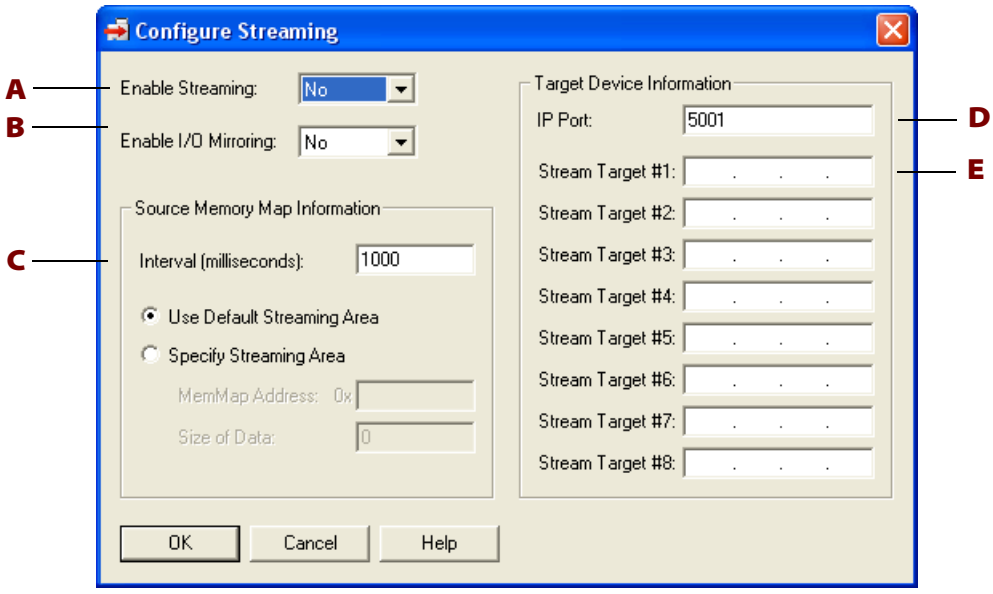
1. In the PAC Manager main window, click the Open button or choose File➞Open.
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. In the configuration tree, right-click the name of the I/O unit on which you want to set up mirroring and choose Configure from the pop-up menu.



4. Make sure the correct I/O unit is highlighted in the list. Click the Communications button and choose Streaming from the pop-up menu.



5. Complete the fields as follows:
   - **A** Streaming is a separate function. It's generally not a good idea to use both streaming and mirroring on the same I/O unit. See "Configuring Streaming" on page 98 for more information.
   - **B** To enable mirroring, choose Yes from the drop-down list.
   - **C** Enter how often in milliseconds the data should be mirrored.

D Enter the IP port number. This is the primary port number used to communicate with the I/O unit. The default shown is 5001; enter 2001 instead. (Exception: if you changed the MMP port for security reasons, use the number you changed it to.)

E Enter the IP address of the I/O unit to receive the mirrored data.

CAUTION: *Since all digital and analog points are mirrored, make sure that the points on the second I/O unit are configured to accept the values that will be written to them.*

6. When all fields are correct, click OK.
7. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Copying Memory Map Data

PAC-R EB UIO EIO

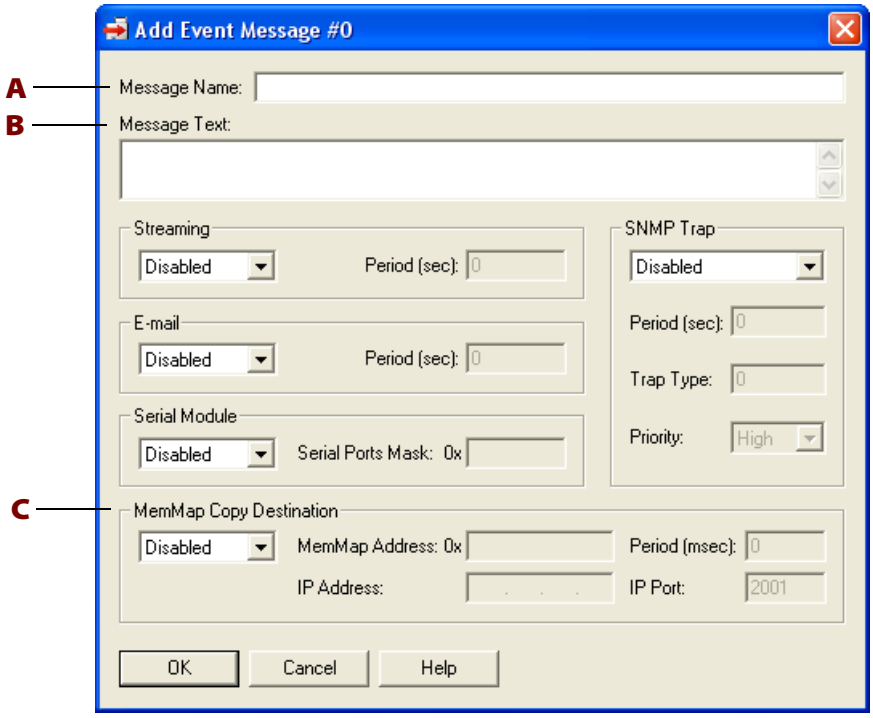
You can use memory map copying to do the following:

- Copy data from one memory map location to another on the same I/O unit
- Copy data from a memory map location on one I/O unit to a memory map location on another unit

Copying Memory Map Data on the Same I/O Unit

You can copy the data in one memory map address to another address on the same I/O unit, for example to write the value of an analog point to another analog point.

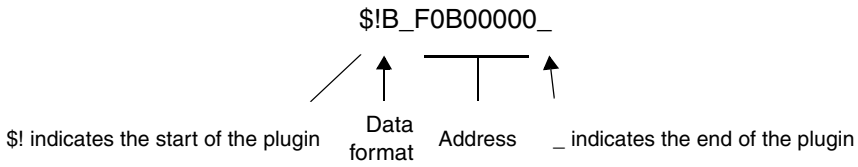
1. Follow the steps in "Configuring Event Messages" on page 86 until you reach the Add Event Message # dialog box.



2. Complete the fields as follows:

A Enter a descriptive name for the message.

In the Message Text section, enter a plugin containing the memory map address you are writing *from* (the source address), in the following format:



B The data format indicator in the plugin can be any of the following, but B is typically used for memory map copying:

D	Integer	B	Binary
F	Float	S	String

C In the MemMap Copy Destination area, choose Enabled from the drop-down list. Enter the Memory Map Address you are copying *to* (the destination address) as an eight-digit hex number (the last eight digits of the address, for example, `F0B00040`). In the Period field, enter how often to send the data, in milliseconds.

Since the points you are copying to are on the same I/O unit, enter 0.0.0.0 for the IP Address, and ignore the IP Port field.

3. When all fields are correct, click OK.

4. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

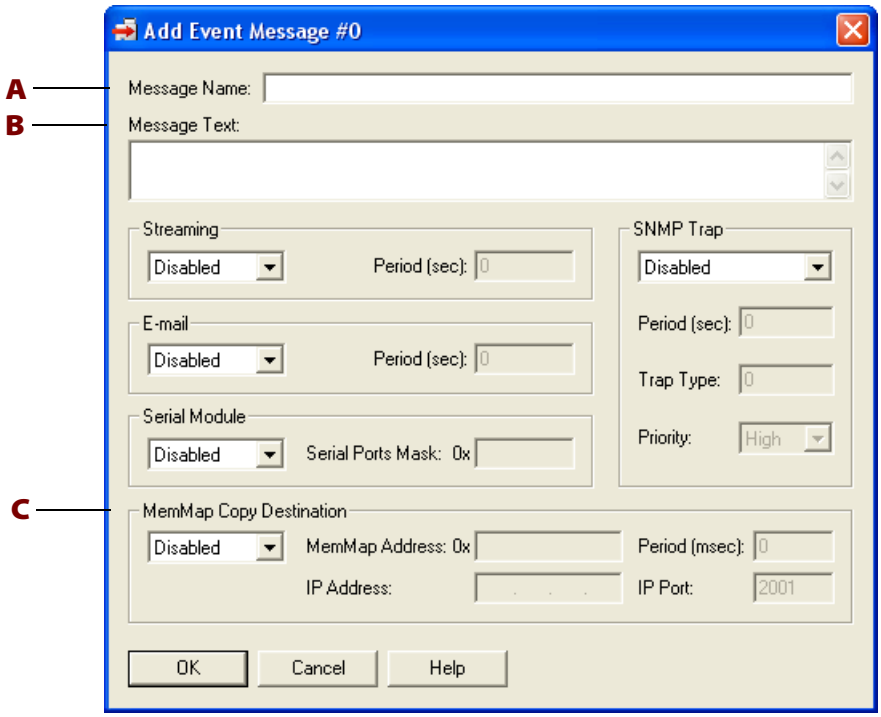
When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

PAC-REB UIO EIO

Copying Memory Map Data to a Different I/O Unit

You can also copy the data in a memory map address to an address on a different system. Configure the event message in the source system (the one you are copying *from*), but make sure that any points you are affecting on the destination system are configured to accept the data.

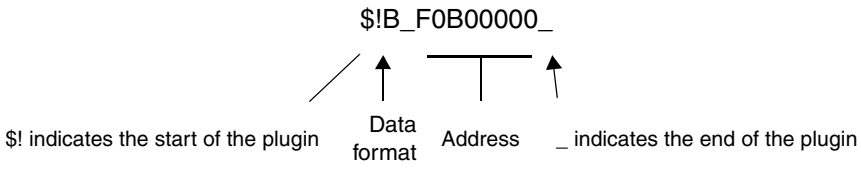
1. Follow the steps in "Configuring Event Messages" on page 86 until you reach the Add Event Message # dialog box.



2. Complete the fields as follows:

   A Enter a descriptive name for the message.

   In the Message Text section, enter a plugin containing the memory map address you are writing *from* (the source address), in the following format:



B The data format indicator in the plugin can be any of the following, but B is typically used for memory map copying:

D	Integer	B	Binary
F	Float	S	String

C In the MemMap Copy Destination area, choose Enabled from the drop-down list. Enter the Memory Map Address you are copying *to* (the destination address) as an eight-digit hex number (the last eight digits of the address, for example, `F0B00040`). In the Period field, enter how often to send the data, in milliseconds.

Also enter the IP Address and IP Port for the I/O unit whose point you are copying to (the destination system). IP port is usually 2001.

3. When all fields are correct, click OK.
4. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Configuring Modbus Options

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

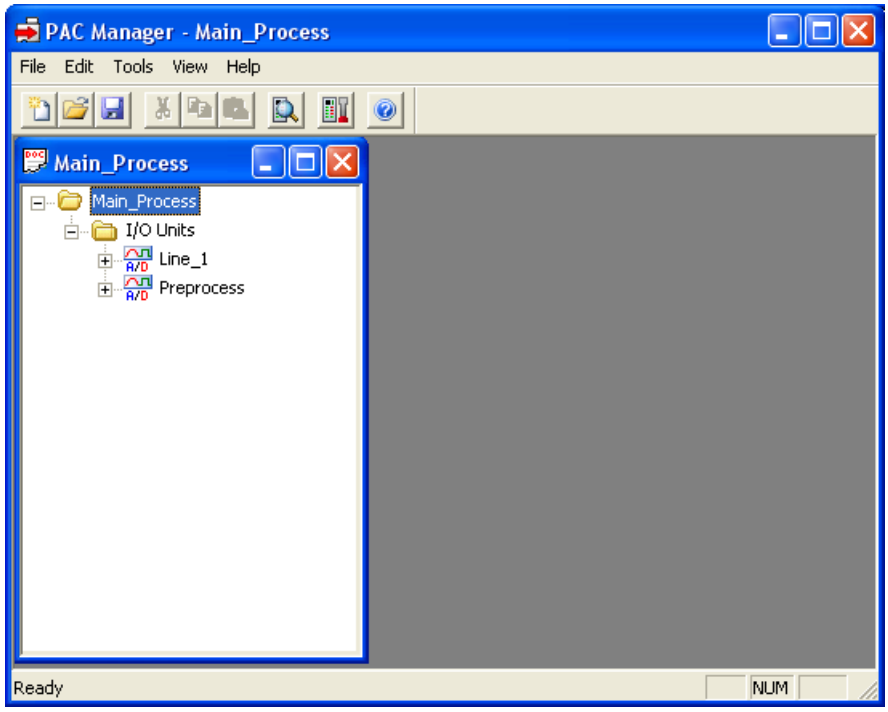
If you are using Modbus/TCP to communicate with a SNAP device, see the *Modbus/TCP Protocol Guide* (form #1678).

Using PAC Manager, you can change the Modbus float format. In addition, if you need to read or write data in areas of the device's memory map that are not included in the Modbus memory map (shown in the protocol guide), you can use PAC Manager to determine the Modbus Unit ID and Register Address that are equivalent to the memory map address you want to use.

Changing Modbus Float Format

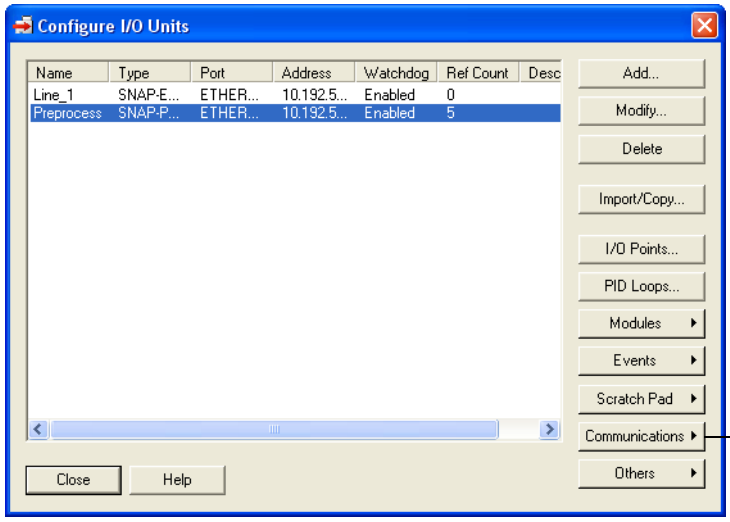
1. In the PAC Manager main window, click the Open button or choose File→Open.

2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.

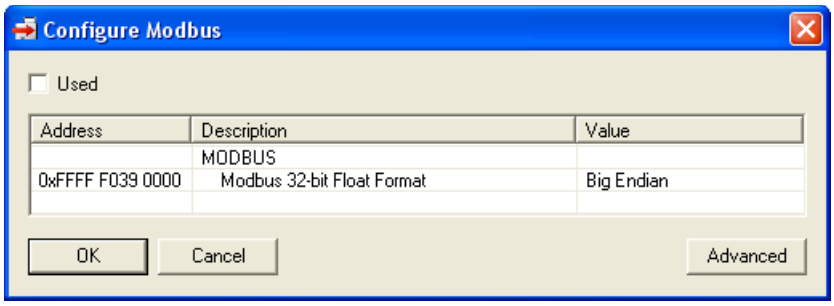


3. In the configuration tree, right-click the name of the I/O unit on which you want to change Modbus float format and choose Configure from the pop-up menu.

   For a SNAP PAC S-series controller, if it does not already appear in the list, add it as an I/O unit of the type Generic OptoMMP Device. (Do not add any points.)



4. Click the Communications button and choose Modbus from the pop-up menu.



5. Click to place a check mark in the Used box. In the Value column, click the value shown for float format. Choose the format you want from the drop-down list.

   NOTE: Word swapped is still Big Endian, but places the most significant bit in the most significant register.

6. When the value you want is shown, click OK.
7. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

PAC-S PAC-R EB UIO EIO SIO E1 E2

Determining Modbus Unit ID and Register Address

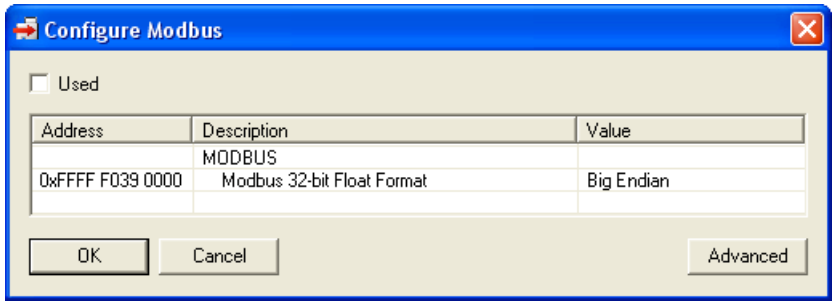
If you need to read or write data to the device's memory map in areas not included in the Modbus memory map (see the *Modbus/TCP Protocol Guide*, form #1678), you can use PAC Manager to convert memory map addresses to Modbus Unit ID and Register Addresses, or vice versa.

1. Determine the device's memory map address (or the Modbus Unit ID and Register Address) you want to convert.

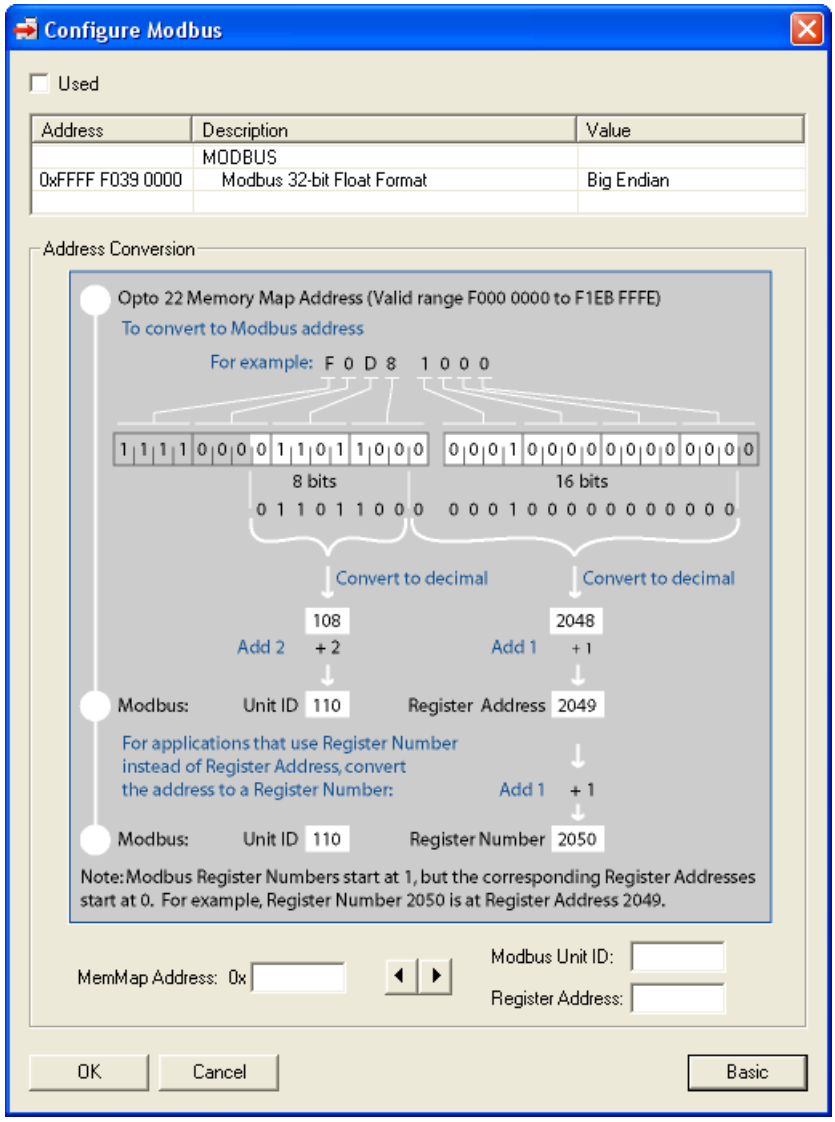
   To find out the memory map address, you can use the memory map appendix in the *OptoMMP Protocol Guide* or copy and paste the address from the Inspect dialog box in PAC Manager.

2. In the PAC Manager main window, with a configuration file open, right-click an I/O unit and choose Configure from the pop-up menu.

3. In the Configure I/O Units dialog box, click the Communications button and choose Modbus from the pop-up menu.



4. Click the Advanced button to see the rest of the dialog box.

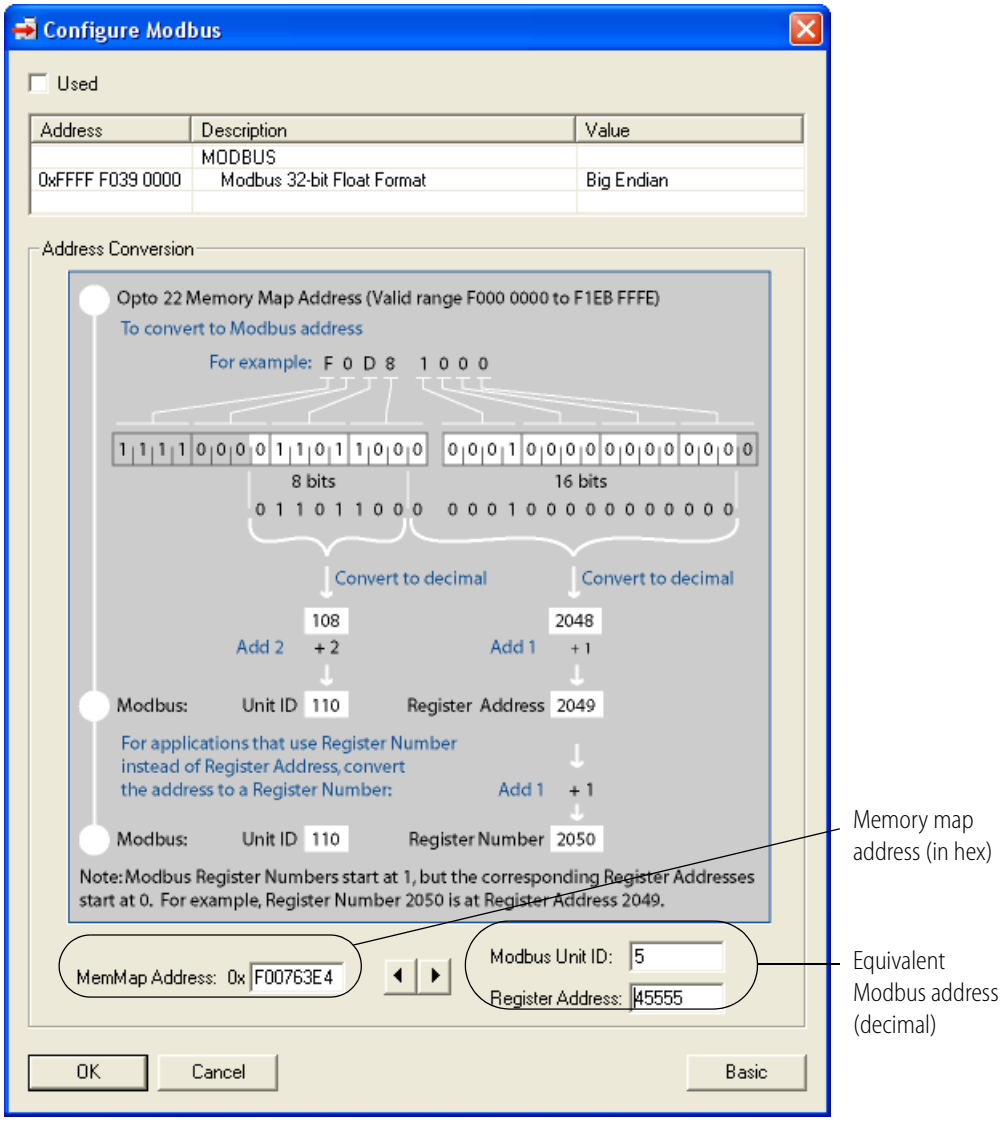

Configure Modbus
Used
Address
Description
Value
MODBUS
0xFFFF F039 0000
Modbus 32-bit Float Format
Big Endian
Address Conversion
Opto 22 Memory Map Address (Valid range F000 0000 to F1EB FFFE)
To convert to Modbus address
For example: F 0 D 8 1 0 0 0
1 1 1 1 0 0 0 0 1 1 0 1 1 0 0 0
0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
8 bits
16 bits
0 1 1 0 1 1 0 0 0
0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
Convert to decimal
Convert to decimal
108
2048
Add 2
+ 2
Add 1
+ 1
Modbus:
Unit ID
110
Register Address
2049
For applications that use Register Number instead of Register Address, convert the address to a Register Number:
Add 1
+ 1
Modbus:
Unit ID
110
Register Number
2050
Note: Modbus Register Numbers start at 1, but the corresponding Register Addresses start at 0. For example, Register Number 2050 is at Register Address 2049.
MemMap Address: 0x
Modbus Unit ID:
Register Address:
OK
Cancel
Basic

5. To convert an I/O unit memory map address to a Modbus Unit ID and Register Address, type the last eight digits of the I/O unit's memory map address in the MemMap Address field.

   Make sure there are no spaces in the address (for example, type `F0300020`).

6. Click the right-arrow button ▶.

   The equivalent Modbus address appears. Note that the Modbus numbers are decimal.


Configure Modbus
Used
Address
Description
Value
MODBUS
0xFFFF F039 0000
Modbus 32-bit Float Format
Big Endian
Address Conversion
Opto 22 Memory Map Address (Valid range F000 0000 to F1EB FFFE)
To convert to Modbus address
For example: F 0 D 8 1 0 0 0
8 bits
16 bits
Convert to decimal
Convert to decimal
108
2048
Add 2 +2
Add 1 +1
Modbus: Unit ID 110 Register Address 2049
For applications that use Register Number instead of Register Address, convert the address to a Register Number:
Add 1 +1
Modbus: Unit ID 110 Register Number 2050
Note: Modbus Register Numbers start at 1, but the corresponding Register Addresses start at 0. For example, Register Number 2050 is at Register Address 2049.
MemMap Address: 0x F00763E4
Modbus Unit ID: 5
Register Address: 45555
OK
Cancel
Basic
Memory map address (in hex)
Equivalent Modbus address (decimal)

7. To convert from Modbus to a memory map address, type the Unit ID and Register Address and click the left-arrow button.

   The equivalent memory map address appears.

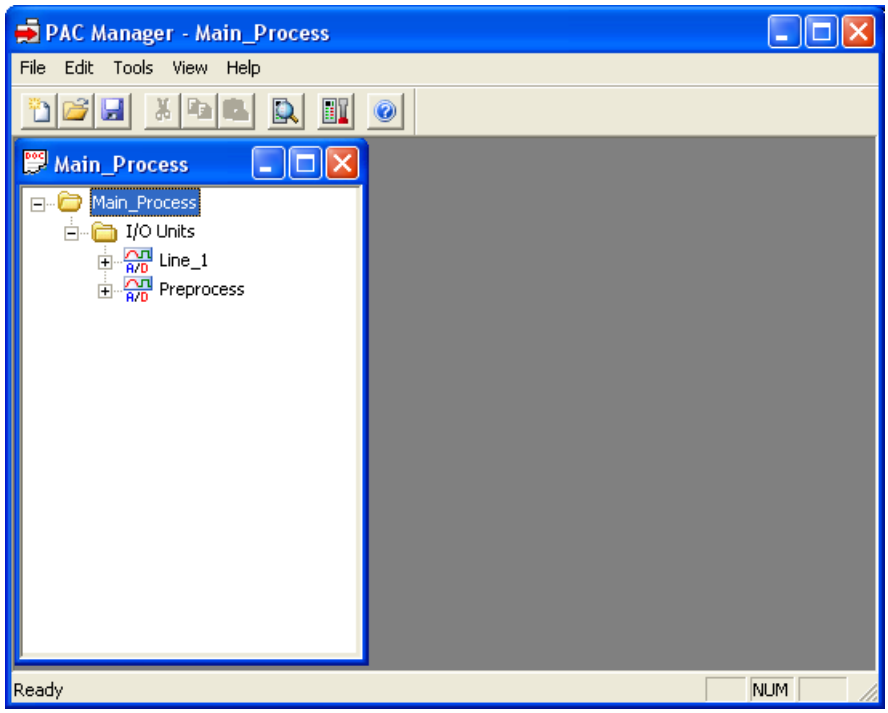
Setting Up System Date and Time

PAC-R
EB
UIO
EIO

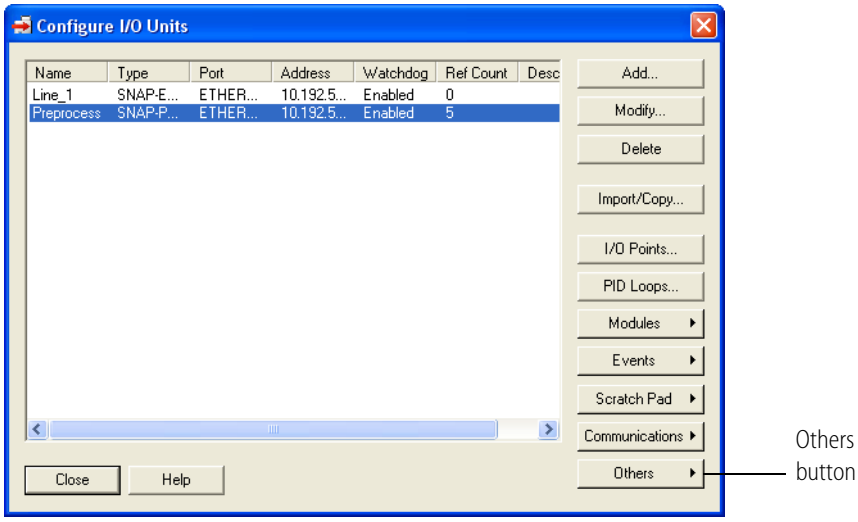
SNAP PAC devices and SNAP Ultimate controllers and SNAP-ENET-RTC Ethernet brains have a built-in clock. (Other SNAP Ethernet-based brains do not have this feature.) The clock is set at the factory before the device is shipped to you. If necessary, you can set the date and time on an I/O unit by following these steps. (For a SNAP PAC S-series controller, see "Reading System Date and Time" on page 180.)

NOTE: If you are using PAC Control and want to synchronize the I/O unit's time with your PC's time, don't use these steps; instead, follow instructions in Opto 22 form #1700, the PAC Control User's Guide.

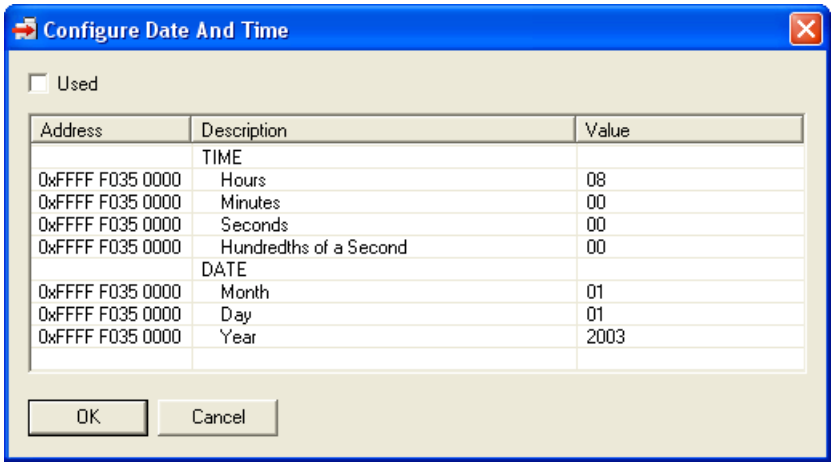
1. In the PAC Manager main window, click the Open button or choose File➞Open.
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. In the configuration tree, right-click the name of the I/O unit on which you want to set the time and date and choose Configure from the pop-up menu.



4. Click the Others button and choose Date and Time from the pop-up menu.



5. Click to put a check mark in the Used box. Enter the correct time and date values in the Value column. Click OK.
6. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

Configuring Direct Serial Communication

PAC-S
PAC-R
UIO

Applies to SNAP PAC and SNAP Ultimate controllers only. (Requires firmware version 5.1c or newer on UIO.) Note that this configuration cannot be saved as part of the configuration file. It must be done separately using PAC Manager's Inspect window.

RS-232 serial connectors are located on the top of SNAP PAC and SNAP Ultimate controllers (two connectors on a standalone controller and one connector on an on-the-rack controller). These ports are sometimes used for maintenance, such as loading new firmware, or for Point-to-Point Protocol (PPP) communication via modem. However, they can also be used to send or receive data directly from a serial device, such as barcode readers, weigh scales, or any intelligent device with a serial port. Communication is done through PAC Control communication handles. (For more information, see "Communication Commands" in Chapter 10 of the *PAC Control User's Guide*.)

NOTE: This section shows you how to configure the controller to talk serially with devices directly connected to it. Serial devices attached to an I/O unit through serial communication modules on the rack are configured differently. See page 48.

Follow steps in the next section for on-the-rack controllers; see page 114 for standalone controllers.

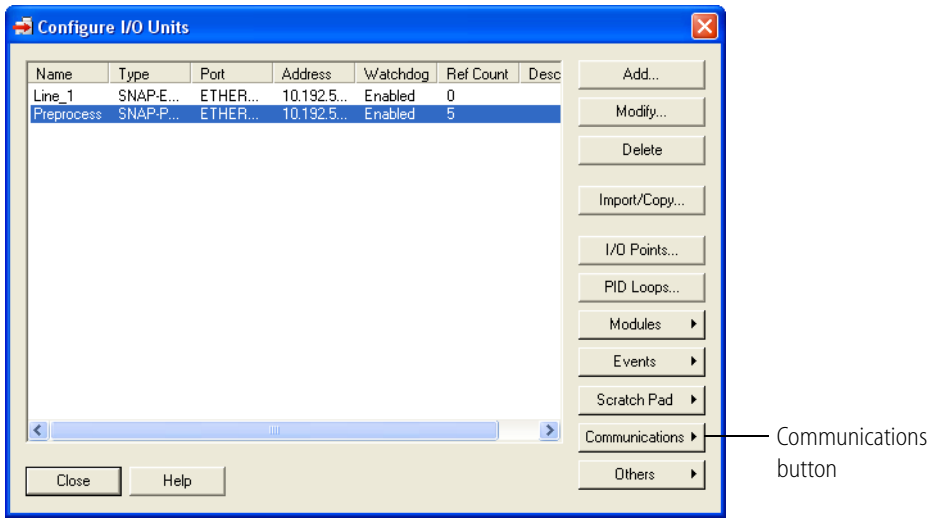
PAC-R
UIO

On-the-Rack Controller

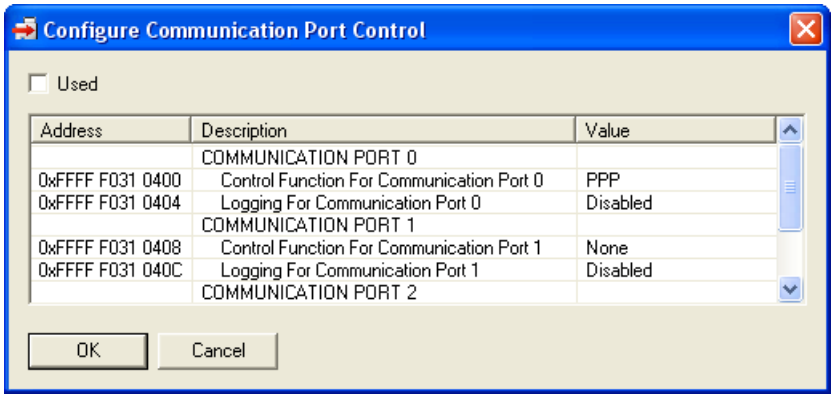
Use these steps for SNAP PAC R-series and SNAP Ultimate I/O.

1. If you are using a SNAP Ultimate brain, make sure it has firmware version 5.1c or newer.

   New firmware can be downloaded from our website, www.opto22.com.
2. In the PAC Manager main window, click the Open button or choose File→Open.
3. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.
4. In the configuration tree, right-click the name of the I/O unit on which you want to configure direct serial communications and choose Configure from the pop-up menu.



5. Click the Communications button and choose Communication Port Control from the pop-up menu.



6. If there is no check mark in the Used box, click the box to place a check mark there.

   Ports shown in the window are as follows:

   – Port 0 = RS-232 connector on controller's top

   – Ports 1 and 2 = Not used

7. If Port 0 is directly connected to a serial device, do the following:
   a. In the Control Function for Communication Port value field, choose None from the drop-down list.
   b. In the Logging for Communication Port field, leave the value field set to Disabled.

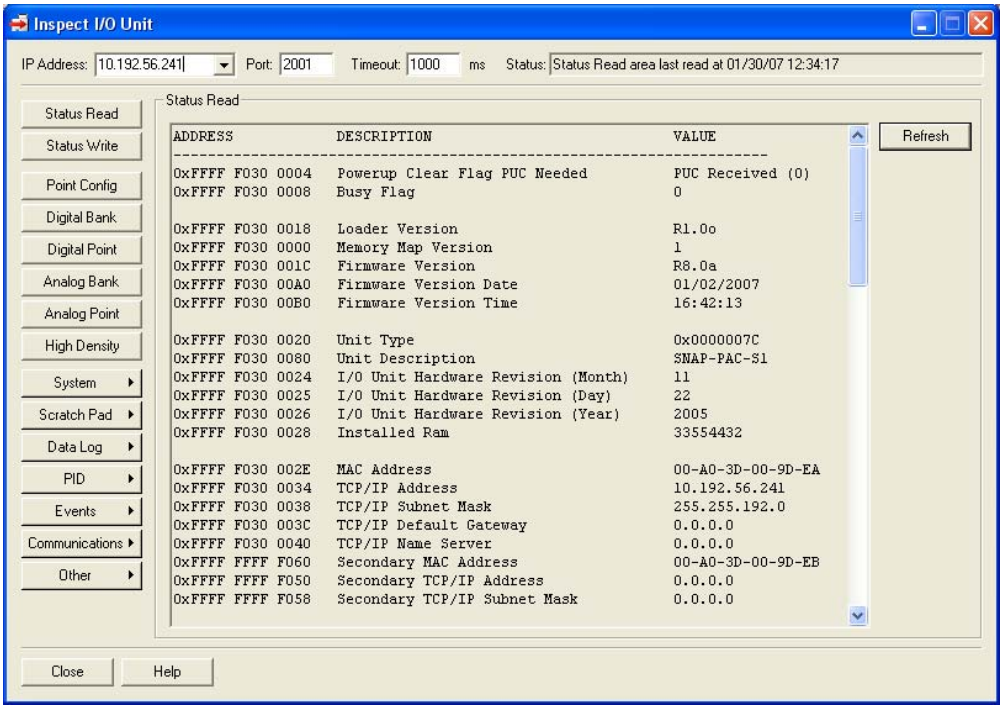
      This log file is used for PPP troubleshooting. When the control function is set to None, the log file logs only characters received by the PAC Control strategy. Since PAC Control is handling the data, you don't need the log file.
8. When you have finished configuring the port, click OK.
9. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

PAC-S Standalone SNAP PAC S-Series Controller

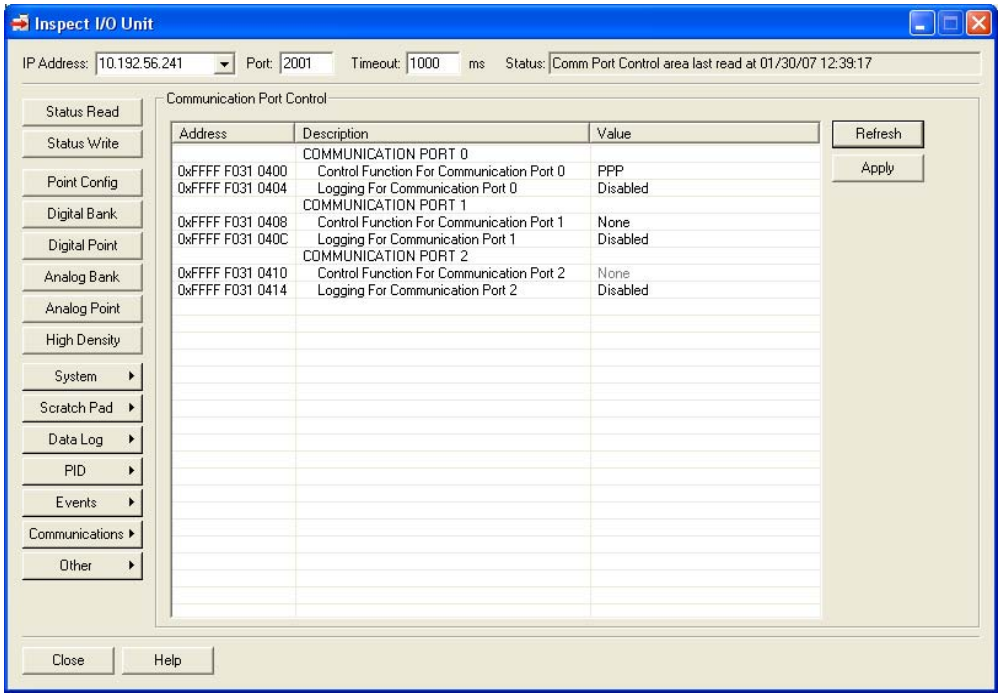
1. In the PAC Manager main window, click the Inspect button .

The Inspect window opens:


Inspect I/O Unit
IP Address: 10.192.56.241
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 12:34:17
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.0o
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/02/2007
0xFFFF F030 00B0 Firmware Version Time 16:42:13
0xFFFF F030 0020 Unit Type 0x0000007C
0xFFFF F030 0080 Unit Description SNAP-PAC-S1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 11
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 22
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2005
0xFFFF F030 0028 Installed Ram 33554432
0xFFFF F030 002E MAC Address 00-A0-3D-00-9D-EA
0xFFFF F030 0034 TCP/IP Address 10.192.56.241
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-9D-EB
0xFFFF FFFF F050 Secondary TCP/IP Address 0.0.0.0
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 0.0.0.0
Close
Help

If you have used the Inspect window before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list. If you have not used the Inspect window before, the window will not show any data.

2. In the IP Address field, type the IP address of the controller (or choose it from the drop-down list). Click Communications and choose Communication Port Control from the submenu.



   – Port 0 = Port S0 on the PAC-S
   – Port 1 = Port S1 on the PAC-S

   For each port that is directly connected to a serial device, do the following:

   a. In the Control Function for Communication Port value field, choose None from the drop-down list.

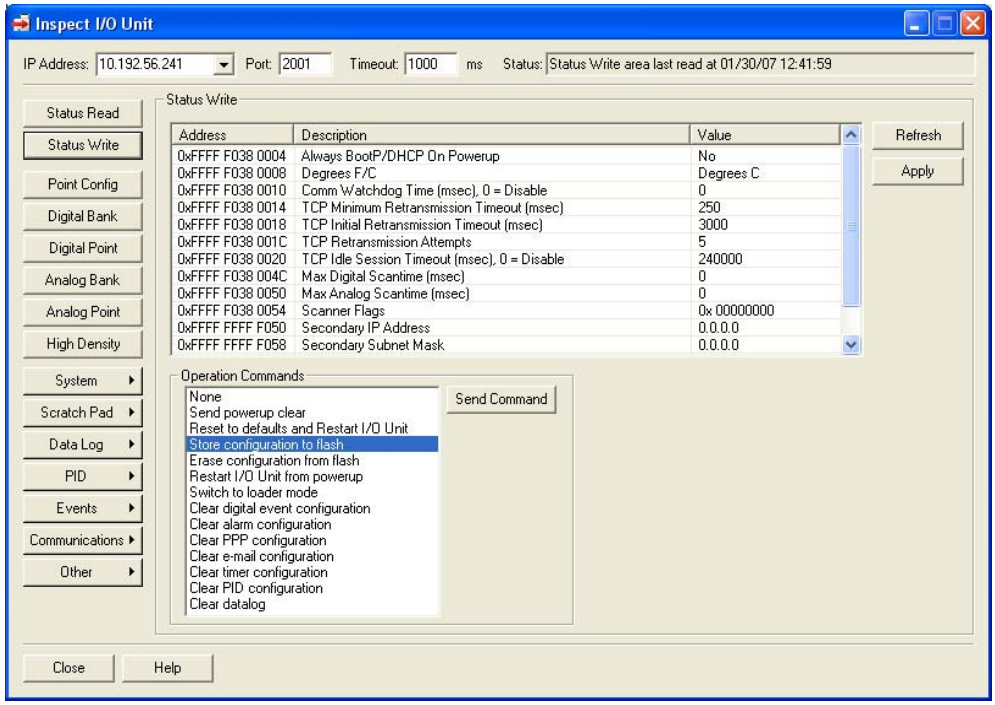
   b. In the Logging for Communication Port field, leave the value field set to Disabled.

   This log file is used for PPP or M2M troubleshooting. When the control function is set to None, the log file logs only characters received by the PAC Control strategy. Since PAC Control is handling the data, you don't need the log file.

3. When you have finished configuring the ports, click Apply.

   Configuration data is sent to the controller.

4. Click the Status Write button on the left side of the Inspect window. In the Operation Command list, highlight Store configuration to flash.



5. Click Send Command.

   The port configuration data is stored to flash memory and a Success message appears.

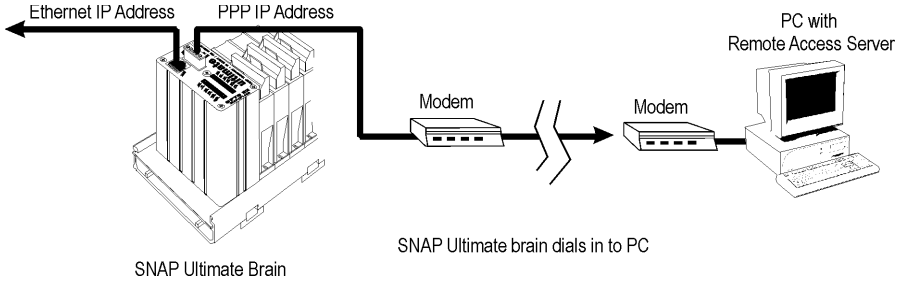
Configuring PPP

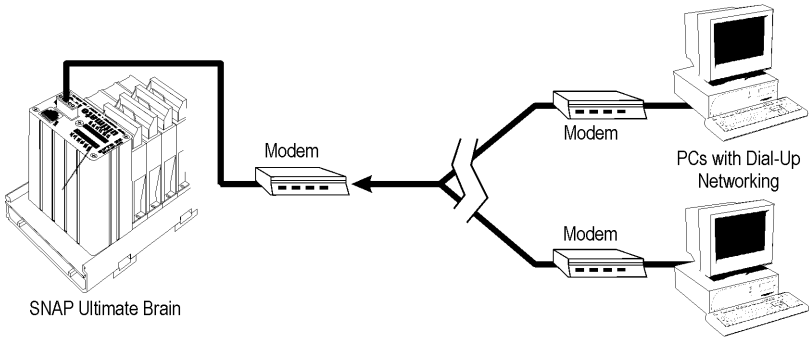
PAC-R EB UIO EIO

Use this section only if you have SNAP PAC, SNAP Ultimate, or SNAP Ethernet I/O units installed at remote locations or in other places where an Ethernet network is not available, and you are using modems to communicate between the device and a PC. You can set up communication so that the device can dial in to a PC, so that PCs can dial into the device, or both.

NOTE: If you are using PPP with a SNAP PAC S-series controller, see instructions in the controller user's guide.

(A SNAP Ultimate I/O unit is shown in the following examples.)





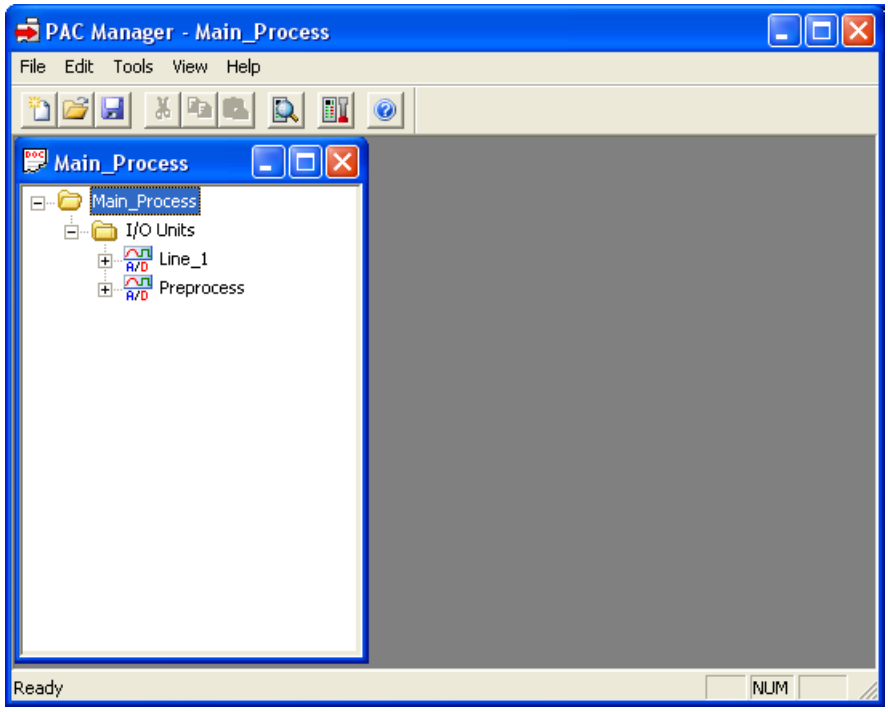
IMPORTANT: *After you have followed the steps in this section to configure PPP on the I/O unit, see the I/O units user's guide for information on attaching the modem to the system and setting up Windows dial-up networking or remote access server on the PC.*

PAC-REB UIO EIO

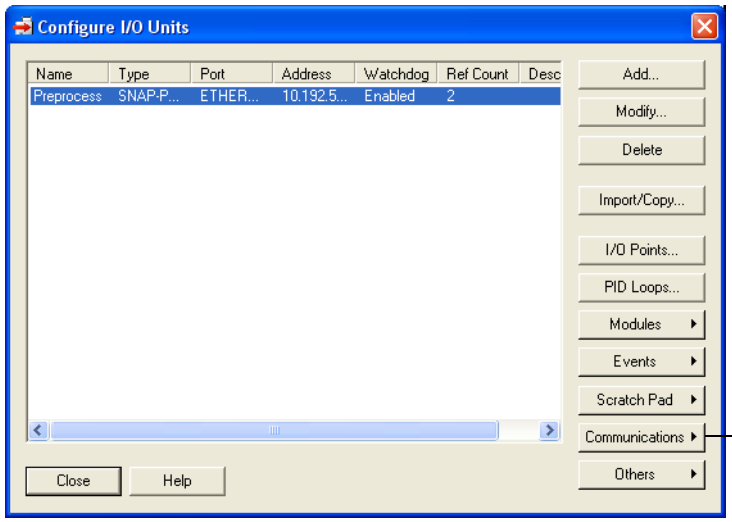
Configuring PPP on the I/O Unit

1. In the PAC Manager main window, click the Open button or choose File→Open.

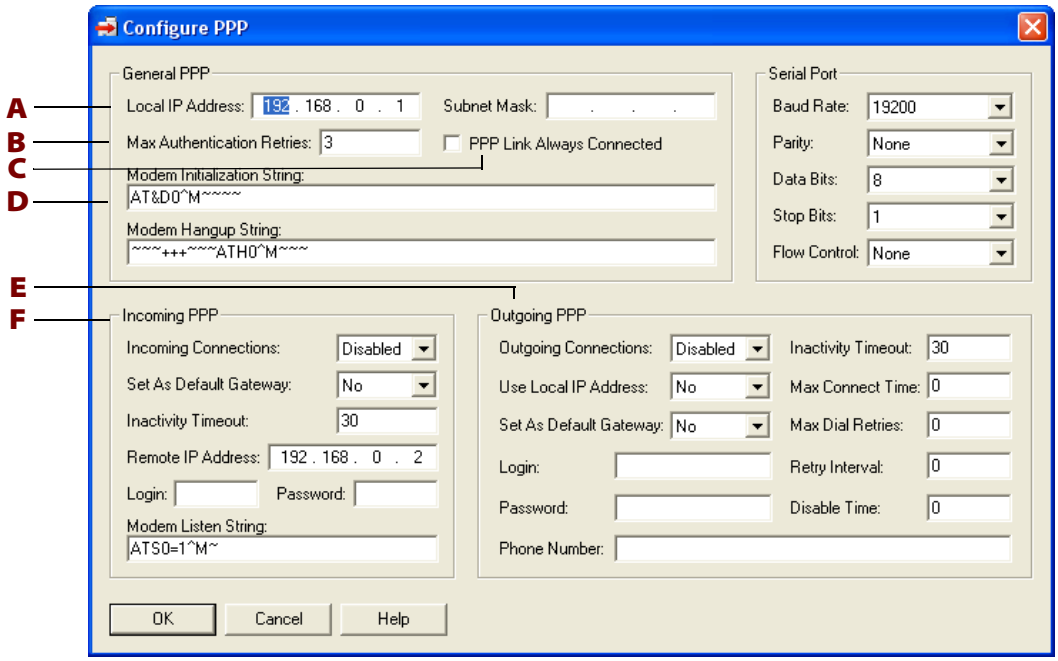
2. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



3. In the configuration tree, right-click the name of the I/O unit on which you want to set up PPP and choose Configure from the pop-up menu.



4. Make sure the correct I/O unit is highlighted in the list. Click the Communications button and choose PPP from the pop-up menu.



5. Complete the fields as follows:

A Enter the Local IP Address for the PPP interface on the I/O unit. Enter the local Subnet Mask only if you are using classless IP addressing. If you are not using classless IP addressing, leave the Subnet Mask at zero, and the I/O unit will calculate the subnet mask.

IMPORTANT: *The network address for the PPP interface must be different from the network ID for the Ethernet interface. (The network address is obtained by ANDing the IP address and the subnet mask.)*

B Enter the maximum number of times a login/password combination can be retried.

C If you want outgoing PPP to always be connected, so there is no need for the I/O unit to dial out, check this box.

D Change the modem initialization string and modem hangup string if necessary. Make sure you use the setting to ignore DTR signal in the modem initialization string:

The default modem initialization string is `AT&D0^M~~~~`

Consult the command reference that came with your modem to determine the correct initialization command strings. A sample modem initialization string might look like this:

```
AT&F^M~~AT&D0&K0^M~~AT&W0^M~~AT&Y0^M~~
```

The &F command sets the modem back to factory defaults. The ^M tells the Ethernet I/O unit to insert a carriage return. The ~ tells it to insert a 500ms pause. The &W0 writes the current settings to NVRAM profile 0 on the modem. The &Y0 instructs the modem to use NVRAM profile 0 after resetting.

This initialization string is just a sample; command strings for your modem may differ.

E If the I/O unit will send outgoing calls, complete the Outgoing PPP section:

Choose Enabled from the drop-down list.

In the Use Local IP Address field, choose Yes to have the I/O unit use the Local IP Address you entered for the PPP link; choose No to have the remote device assign the I/O unit an IP address for the PPP link. The default is No.

If you want the I/O unit to use the device the I/O unit is calling as the default gateway for all communication, choose Yes for Set As Default Gateway. The default is No.

Enter the Login and Password the I/O unit should use for authentication when it calls the remote device.

In the Phone number field, enter the number the modem should dial for outgoing calls from the I/O unit.

Change the following fields if necessary:

- Inactivity Timeout—If the I/O unit sends no packets and receives no packets for this number of seconds after the PPP session is negotiated, the modem will hang up. The default is 30.
- Max Connect Time—The maximum amount of time in seconds an outgoing PPP connection can stay connected after successful negotiation. Default is zero, which disables the timer.
- Max Dial Retries—The number of times the I/O unit will redial if the first attempt fails. Default is zero.
- Retry Interval—The number of seconds the I/O unit will wait before trying to redial after the first attempt fails. Default is zero.
- Disable Time—If the maximum connect time or maximum number of retries has been reached, the outgoing PPP dialer waits this number of seconds before doing anything. Default is zero.

F If the I/O unit will receive incoming calls via modem, complete the Incoming PPP section:

Choose Enabled from the drop-down list so the modem will listen for incoming calls.

If you want the I/O unit to use the device calling the I/O unit as the default gateway for all communication, choose Yes for Set As Default Gateway. The default is No.

Change the Inactivity Timeout if necessary. The default is 30.

Enter the Login and Password the I/O unit should accept for incoming calls.

In the Remote IP Address field, enter the IP address the I/O unit should give to devices that dial into the I/O unit and ask for an address. This address must be on the same subnet as the local IP address.

Enter a modem listen string to make sure the modem automatically answers calls. The default modem listen string is `ATS0=1^M~` , which instructs the modem to answer any incoming calls on the first ring. Again, refer to your modem's command reference for the correct listen string.

6. When all fields are correct, click OK.

IMPORTANT: *For the configuration to take effect, you must upload the configuration file to the I/O unit, save it to flash memory, and restart the I/O unit.*

NOTE: On a SNAP PAC R-series or SNAP Ultimate I/O unit, if the serial port you are using for PPP was previously used for a direct connection with a serial device, you must use PAC Manager's Inspect window to reset the port configuration from None to PPP. See page 113 for more information.

7. Configure other optional functions, or return to the PAC Manager main window and click the Save button to save the configuration file.

When you are ready to upload the configuration file to the I/O unit, see "Sending Configuration Data to the I/O Unit" on page 67.

See the *SNAP Ethernet-Based I/O Units User's Guide* or the *SNAP PAC R-Series Controller User's Guide* for information on attaching the modem to the system and setting up Windows dial-up networking or remote access server on the PC.

Setting Up Events and Reactions

Introduction

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Events and reactions are automatic responses to conditions monitored by SNAP PAC, SNAP Ultimate, and SNAP Ethernet I/O units. (E1, E2, and SNAP Simple I/O units do not support this feature.)

The monitored conditions, called events, and the responses to them, called reactions, can be simple or complex. An example of a simple event/reaction is turning on a fan in response to a rise in temperature. Complex event/reactions may involve multiple events and multiple reactions, with a time delay in between. For example, you could set up a temperature limit as an event that triggers a warning light, and a higher temperature limit as an event that sets off an audible alarm and sends an email message.

CAUTION: *Event/reactions you set up using these instructions in this chapter operate on the I/O side of a SNAP PAC R-series or SNAP Ultimate controller, independently of any PAC Control strategy running on the processor's control side. If you are using PAC Control with a SNAP PAC R-series or SNAP Ultimate I/O system, do not use this chapter. Instead, use the flowchart logic in the PAC Control strategy to handle reactions to events. The only reason you might set up event/reactions that operate independently on the I/O side of the controller would be a need for very fast reactions. If that is the case, be very careful that the event/reactions you set up do not conflict with PAC Control logic.*

The chapter introduces you to the Scratch Pad and other basic event/reaction concepts. It also shows you how to use PAC Manager to configure the following:

Digital event/reactions see page 128

Alarm event/reactions see page 133

Serial or Wiegand event/reactions see page 136

Timed event/reactions see page 138

Event messages see page 140

Event/Reaction Concepts

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The Scratch Pad

SNAP PAC S-series and SNAP-LCE standalone controllers, SNAP PAC R-series and SNAP Ultimate on-the-rack controllers, and SNAP PAC and SNAP Ethernet brains contain Scratch Pad areas within their memory maps. (SNAP Simple brains and E1 and E2 brain boards do not contain a Scratch Pad.) Scratch Pad areas can be used for two main purposes:

- as a place to hold data being transferred from one peer to another on the network (SNAP PAC S-series and R-series, SNAP-LCE, and SNAP Ultimate only)
- as a virtual notebook for keeping track of events and alarms (SNAP PAC R-series, SNAP PAC brains, SNAP Ultimate, and SNAP Ethernet only)

The Scratch Pad is user-defined, meaning that you define and use its addresses to fit your needs, and you can redefine them whenever necessary. The Scratch Pad area includes up to four sections, depending on device type, to accommodate different types of data: bits, strings, floats, and integers.

- The Scratch Pad bits section is a 64-bit mask.
- The Scratch Pad strings section is a table of 64 elements. Each element can hold 128 characters or 128 bytes of binary data.
- The Scratch Pad float section is a table of 10,240 elements; each float is four bytes.
- The Scratch Pad integer section is also a table of 10,240 four-byte elements.

NOTE: Scratch Pad string, float, and integer tables are not made up of contiguous addresses in the memory map; each table is in two address sections. You won't notice this if you are using PAC Control, but if you are addressing these tables in another application, check the memory map appendix in the OptoMMP Protocol Guide to make sure you have the correct addresses for the table elements you want.

Scratch Pad strings, floats, and integers are available for SNAP PAC R-series, S-series, and SNAP Ultimate I/O and are primarily used to transfer data from one peer to another on the network. For more information on using the Scratch Pad in this way, see "Communication Commands" in Chapter 10 of the *PAC Control User's Guide*. (You can also use PAC Manager for one-time reads and writes; see "Reading and Writing to the Scratch Pad Area" on page 180.)

Scratch Pad bits are available for both standalone and on-the-rack controllers and for SNAP Ethernet I/O units. Controllers and Ultimate I/O units usually use them in the same way as strings, floats, and integers—they're just another data format—but in Ethernet I/O units, Scratch Pad bits are primarily used for tracking events and alarms.

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Using Scratch Pad Bits for Events and Alarms

When Scratch Pad bits are used to track events and alarms, the 64 bits in the mask do not represent point numbers. Instead, they represent whatever you decide they should be. For example, you might decide that bit 1 in the Scratch Pad will indicate a temperature level in Vat #12 (if the

temperature reaches 48 °C, bit 1 is turned on). Bit 2 might indicate the status of Pump A (if the pump is off, the bit is off; if the pump is on, the bit is on).

Because you can use Scratch Pad bits to keep track of digital and serial events and analog and digital alarms, you can set up reactions based on a variety of digital, analog, and serial conditions. In the example above, you could set up a reaction that sends a stream packet if bit 1 is on and bit 2 is off.

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Types of Events, Alarms, and Reactions

NOTE: Digital events and reactions are available for points on 4-channel digital modules, not for points on high-density digital modules.

You can configure the I/O unit to recognize one or a combination of the following as an event:

- The on or off state of a digital point on a 4-channel digital module
- A specific high or low value of an analog point, in Engineering Units
- A specific number on a digital counter or a high or low number on a quadrature counter
- An analog point value or a quadrature counter that is outside an allowable range
- The state of a bit in the Scratch Pad (on or off)
- A specific string received by a serial module

You can also set up the I/O unit to react automatically to an event in any or all of the following ways:

- Turning on or off digital points on a 4-channel digital module, on the same I/O unit
- Turning on or off digital points on a 4-channel digital module, on a different I/O unit
- Copying data from one memory map location to another on the same or a different I/O unit
- Logging data
- Turning a bit in the Scratch Pad on or off
- Sending a stream packet
- Sending an email message
- Sending a string through a serial module to a serial device
- Sending an SNMP trap

In addition, you can use a timer to set up a delay between when the event occurs and the reaction takes place.

NOTE: At present, it is not possible to set up an automatic analog reaction.

The following table shows how to configure possible events and reactions to occur either immediately or after a delay. Page references give you more detailed information for steps.

Event	Reaction	When?	Configuration Steps	See
If digital point is on/off	Turn digital point on/off (on same I/O unit)	Now	Configure Digital Events	page 128
		After a delay	Configure Timers	page 138
	Turn digital point on/off (on different I/O unit) OR Log data OR Copy memory map data OR Send message (stream, e-mail, serial, or SNMP trap).	Now	1. Configure Digital Events—set Scratch Pad bit 2. (Except data logging) Configure Event Messages—send message or data (Data logging) Configure Data Logging and configure email (optional)	page 128 page 86 page 82 page 93
		After a delay	1. Configure Timers—set Scratch Pad bit 2. (Email message only) Configure Email (Streaming only) Configure Streaming (SNMP only) Configure SNMP 3. (Except data logging) Configure Event Messages—send message or data (Data logging) Configure Data Logging and configure Email (optional)	page 138 page 93 page 98 page 90 page 86 page 82 page 93
If analog point value (Engineering Units) goes above or below a specified value OR If digital counter reaches a specified value	Turn digital point on/off (on same I/O unit).	Now	1. Configure Alarm Events (high alarm or low alarm)—set Scratch Pad bit 2. Configure Digital Events—turn on/off point	page 133 page 128
		After a delay	1. Configure Alarm Events (high alarm or low alarm)—set Scratch Pad bit 2. Configure Timers—turn on/off point	page 133 page 138
	Turn digital point on/off (on different I/O unit) OR Copy memory map data OR Log data OR Send message (stream, email, serial, or SNMP trap).	Now	1. Configure Alarm Events (high alarm or low alarm)—set Scratch Pad bit 2. (Except data logging) Configure Event Messages—send message or data (Data logging) Configure Data Logging and configure Email (optional)	page 133 page 86 page 82 page 93
		After a delay	1. Configure Alarm Events (high alarm or low alarm)—set Scratch Pad bit 2. Configure Timers—set time delay and set a Scratch Pad bit after timer expires 3. (Email message only) Configure Email (Streaming only) Configure Streaming (SNMP only) Configure SNMP 4. (Except data logging) Configure Event Messages—send message or data based on timer-expired bit (Data logging) Configure Data Logging based on timer-expired bit and configure Email (optional)	page 133 page 138 page 93 page 98 page 90 page 86 page 82 page 93

Event	Reaction	When?	Configuration Steps	See
If analog point value (Engineering Units) or quadrature counter goes outside an allowable range	Turn digital point on/off (on same I/O unit)	Now	1. Configure Alarm Events (deviation alarm)—set Scratch Pad bit 2. Configure Digital Events—turn on/off point	page 133 page 128
		After a delay	1. Configure Alarm Events (deviation alarm)—set Scratch Pad bit 2. Configure Timers—turn on/off point	page 133 page 138
	Turn digital point on/off (on different I/O unit) OR Copy memory map data OR Log data OR Send message (stream, email, serial, or SNMP trap).	Now	1. Configure Alarm Events (deviation alarm)—set Scratch Pad bit 2. (Except data logging) Configure Event Messages—send message or data (Data logging) Configure Data Logging and configure Email (optional)	page 133 page 86 page 82 page 93
		After a delay	1. Configure Alarm Events (deviation alarm)—set Scratch Pad bit 2. Configure Timers—set time delay and set a Scratch Pad bit after timer expires 3. (Email message only) Configure Email (Streaming only) Configure Streaming (SNMP only) Configure SNMP 4. (Except data logging) Configure Event Messages—send message or data based on timer-expired bit (Data logging) Configure Data Logging based on timer-expired bit and configure Email (optional)	page 133 page 138 page 93 page 98 page 90 page 86 page 82 page 93
If a specific string is received by a serial module	Turn digital point on/off (on same I/O unit)	Now	1. Configure Serial Events—set Scratch Pad bit 2. Configure Digital Events—turn on/off point	page 136 page 128
		After a delay	1. Configure Serial Events—set Scratch Pad bit 2. Configure Timers—turn on/off point	page 136 page 138
	Send SNMP trap	Now	1. Configure Serial Events—send SNMP trap 2. Configure SNMP	page 136
		After a delay	1. Configure Serial Events—set Scratch Pad bit 2. Configure Timers—set time delay and set a Scratch Pad bit after timer expires 3. Configure SNMP 4. Configure Event Messages—send trap based on timer-expired bit	page 136 page 138 page 90 page 86
	Send one-time email	Now	1. Configure Serial Events—send email 2. Configure Email	page 136
	Turn digital point on/off (on different I/O unit) OR Copy memory map data OR Log data OR Send message (stream, serial, or multiple emails)	Now	1. Configure Serial Events—set Scratch Pad bit 2. (Except data logging) Configure Event Messages—send message or data (Data logging) Configure Data Logging and configure Email (optional)	page 136 page 86 page 82 page 93
		After a delay	1. Configure Serial Events—set Scratch Pad bit 2. Configure Timers—set time delay and set a Scratch Pad bit after timer expires 3. (Email message only) Configure Email (Streaming only) Configure Streaming 4. (Except data logging) Configure Event Messages—send message or data based on timer-expired bit (Data logging) Configure Data Logging based on timer-expired bit and configure Email (optional)	page 136 page 138 page 93 page 98 page 86 page 82 page 93

Configuring Digital Events and Reactions

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In a digital event, the I/O unit monitors one or more inputs and outputs for a match to a specific pattern (the event). When the pattern is matched, the I/O unit reacts in a predetermined way. You can configure up to 128 digital events and reactions.

NOTE: Digital events and reactions are available for points on 4-channel digital modules, but not for points on high-density digital modules.

Digital event/reactions can be as simple as turning on a light (reaction) when a door opens (event). They can also be very complex, depending on your needs. For example, suppose you need to monitor a critical group of switches. If switches 1, 2, and 3 are all off at once, you want to turn on an emergency light and sound an alarm. You can set up a digital event for the state of the three switches, and a reaction that automatically turns on the emergency light and alarm.

The reaction to a digital event can turn digital points on or off and can also set bits in the Scratch Pad. The reaction can also depend on alarm conditions noted in the Scratch Pad. For instance, to regulate the temperature of a room, you might set up an alarm event that turns on a bit in the Scratch Pad when the temperature reaches 78° F (see "Configuring Alarms and Reactions" on page 133). Then you would set up a digital event/reaction to turn on an air conditioning unit when that Scratch Pad bit is on.

NOTE: If you want to turn on or off digital points that are located on a different I/O unit, you can do so by using the memory map copying feature. See "Copying Memory Map Data" on page 103 for details.

Digital Point and Scratch Pad Masks

Both events and reactions are in the form of a mask. Digital point masks represent the 64 possible digital I/O points on a 16-module rack of 4-channel digital modules. Scratch Pad masks represent whatever you decide each bit should be.

For each digital event/reaction, you set up eight masks, four for the event and four for the reaction:

For the event:

- Digital points that must be on
- Digital points that must be off
- Scratch Pad bits that must be on
- Scratch Pad bits that must be off.

For the reaction:

- Digital points that should be turned on
- Digital points that should be turned off
- Scratch Pad bits that should be turned on
- Scratch Pad bits that should be turned off.

The masks work as a group. All the event masks must be a match for the I/O unit to send the reaction. If it doesn't matter whether a specific point or bit is on or off, leave its value at zero in both the on mask and the off mask.

When you configure events and reactions, the masks are in hex notation. If you are setting up a Digital On mask for points 0–7, for example, you might do so as follows:

Module position:	1				0			
Point number:	3	2	1	0	3	2	1	0
State:	On	--	On	On	--	--	--	On
Binary notation:	1	0	1	1	0	0	0	1
Hex notation:	B				1			

For more information on mask data format, see page 190. See the following pages for a step-by-step example to set up event/reactions.

You can also configure the I/O unit to send a message as a reaction to digital events. See page 86.

How Digital Events Trigger Reactions

Reactions to digital events are level-triggered, not edge-triggered. The I/O unit continually checks the digital state to see if it matches the event. The I/O unit sends the reaction as soon as the state matches the event, and it continues to send the reaction until the state changes. If the state changes so that it no longer matches the event, the I/O unit does NOT reverse the reaction.

Example: Digital Event/Reaction

For example, suppose you have set up an event/reaction to turn on a light when a door is open. As soon as the event occurs (the door opens), the I/O unit sends the reaction (turn on the light). Since the reaction is level-triggered, as long as the door remains open, the light will remain on.

When the door is shut, the I/O unit stops turning on the light, but it does NOT turn the light off. To turn off the light when the door is shut, you need to set up a second event/reaction.

Suppose the input for the door's status is on point 0 on the module in position 0, and the output for the light is on point 1 on the module in position 1. Here are the two event/reactions to turn on the light when the door is open, and turn off the light when the door is shut:

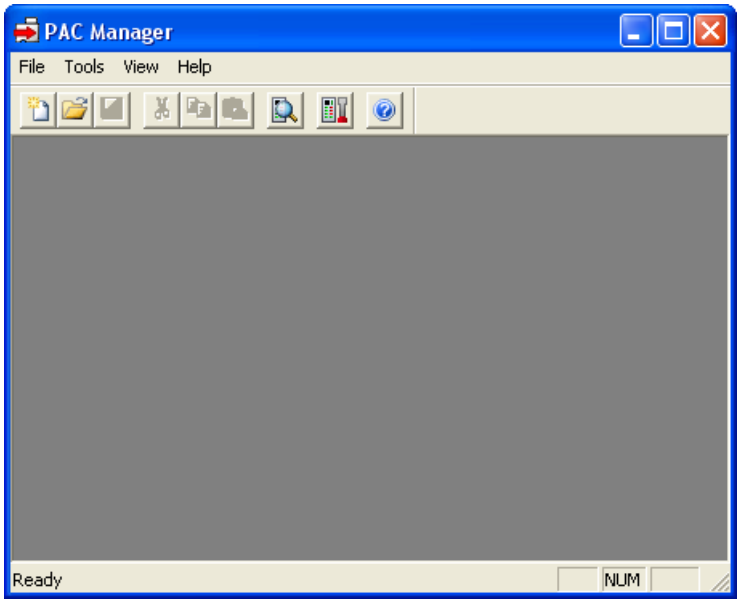
Event #0:	IF	Mod 0 Pt 0 (Door) is	OFF (Open)
Reaction #0:	THEN	Turn Mod 1 Pt 1 (Light)	ON

Event #1:	IF	Mod 0 Pt 0 (Door) is	ON (Closed)
Reaction #1:	THEN	Turn Mod 1 Pt 1 (Light)	OFF

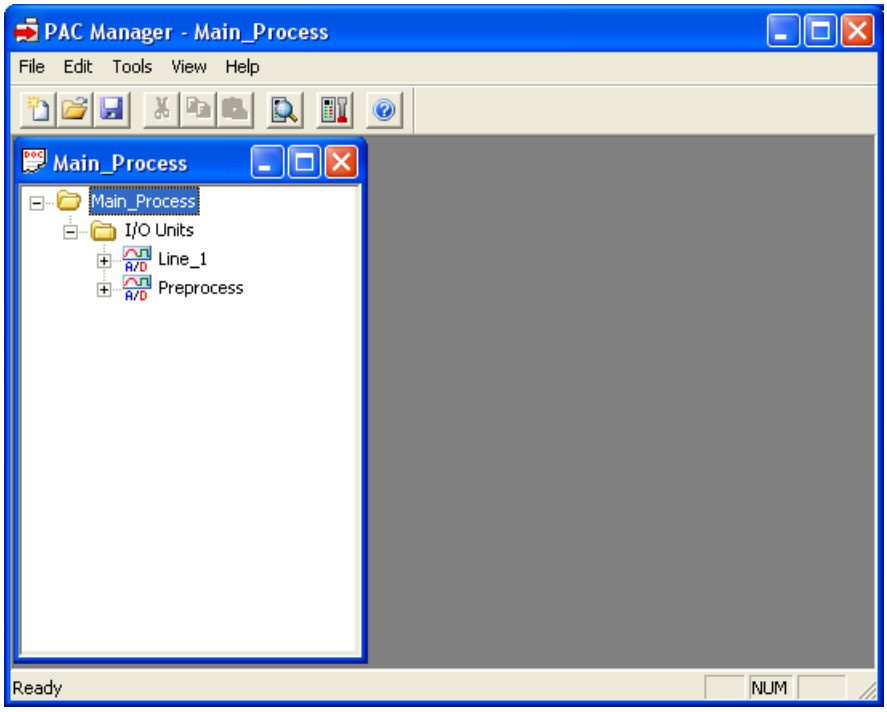
Since this example is a simple one-to-one correspondence, it is pretty easy to set up.

1. If PAC Manager is not already open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

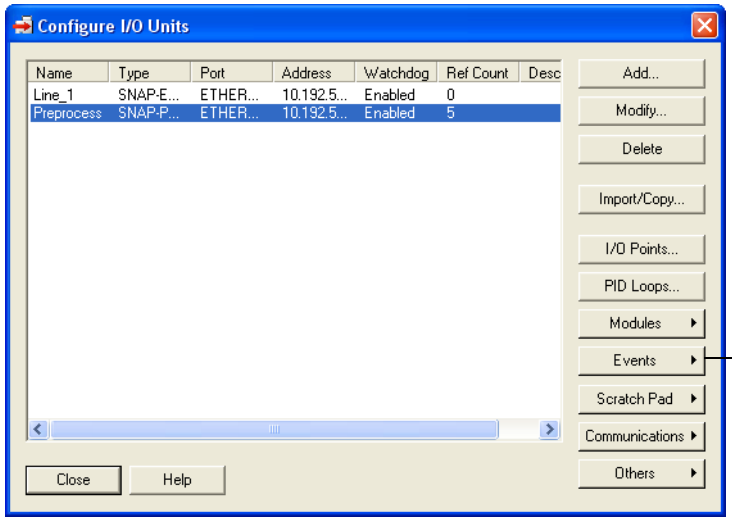
   The PAC Manager main window opens:



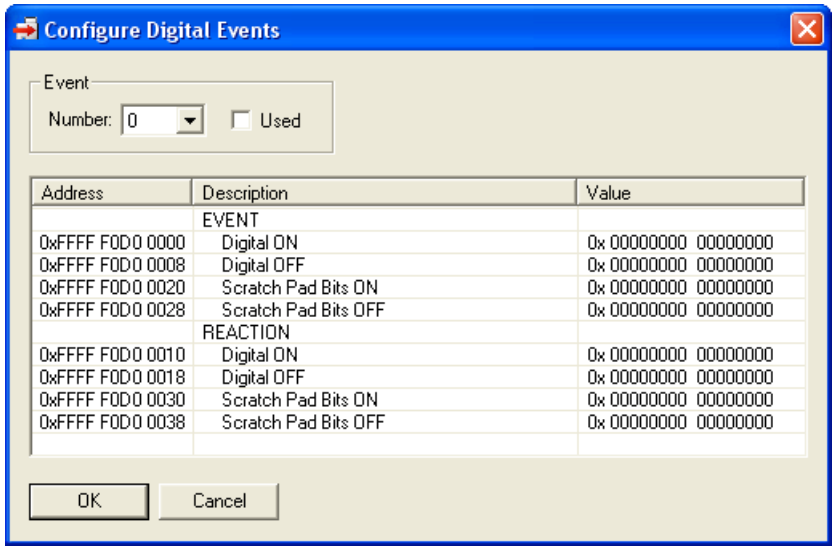
2. Click the Open button or choose File→Open.
3. In the Open Tag Database dialog box, navigate to the configuration file and double-click it to open it.



4. In the configuration tree, right-click the name of the I/O unit on which you want to set up digital events and choose Configure from the pop-up menu.



5. Click the Events button and choose Digital Events from the pop-up menu.


Configure Digital Events
Event
Number: 0
Used
Address
Description
Value
EVENT
0xFFFF F0D0 0000 Digital ON 0x 00000000 00000000
0xFFFF F0D0 0008 Digital OFF 0x 00000000 00000000
0xFFFF F0D0 0020 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D0 0028 Scratch Pad Bits OFF 0x 00000000 00000000
REACTION
0xFFFF F0D0 0010 Digital ON 0x 00000000 00000000
0xFFFF F0D0 0018 Digital OFF 0x 00000000 00000000
0xFFFF F0D0 0030 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D0 0038 Scratch Pad Bits OFF 0x 00000000 00000000
OK
Cancel

6. In the drop-down list, choose the lowest unused Event Number. Click to place a check mark in the Used box.

NOTE: To reduce scanning time, the I/O unit stops scanning digital events when it reaches an unused event. Make sure you use event numbers in order, starting with the lowest.

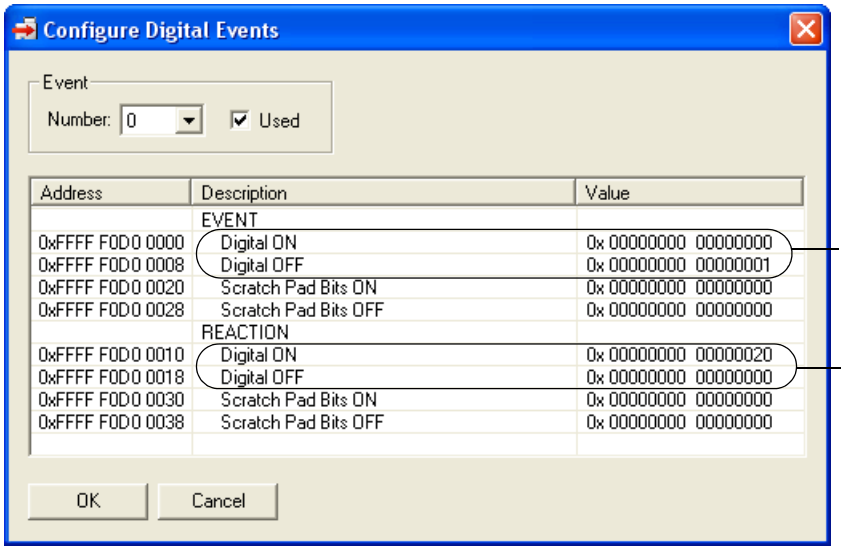
7. In the Event section, enter the Digital OFF mask for the open door. In the Reaction section, enter the Digital ON mask to turn on the light.

Remember that the masks are in hex notation. Here's how you might figure out the Digital ON mask to turn on the light:

Module position:	15				→	1				0			
Digital point:	3	2	1	0	→	3	2	1	0	3	2	1	0
State:	--	--	--	--	→	--	--	On	--	--	--	--	--
Binary notation:	0	0	0	0	→	0	0	1	0	0	0	0	0
Hex notation:	0				→	2				0			

You don't need to enter anything in the Scratch Pad section, because the open door is the only dependency for this event.

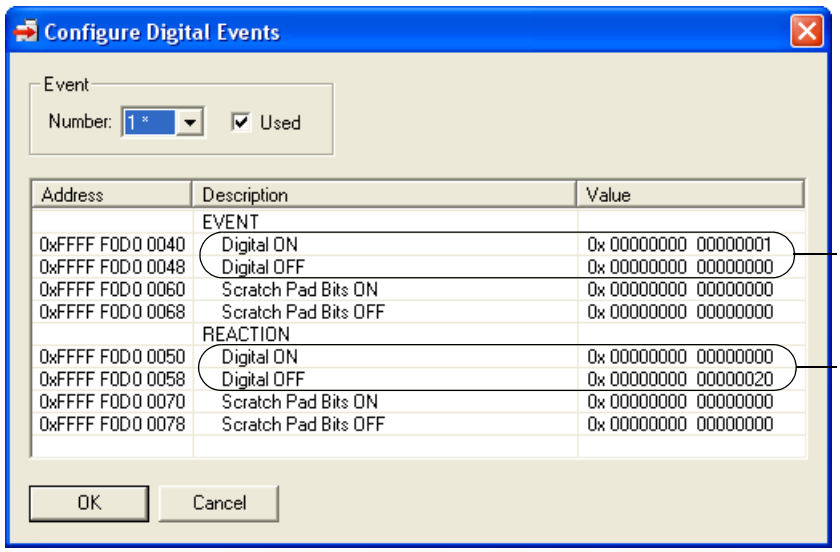
Here's how the Event and Reaction sections would appear if you were using Event #0:


Configure Digital Events
Event
Number: 0
Used
Address
Description
Value
EVENT
0xFFFF F0D0 0000 Digital ON 0x 00000000 00000000
0xFFFF F0D0 0008 Digital OFF 0x 00000000 00000001
0xFFFF F0D0 0020 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D0 0028 Scratch Pad Bits OFF 0x 00000000 00000000
REACTION
0xFFFF F0D0 0010 Digital ON 0x 00000000 00000020
0xFFFF F0D0 0018 Digital OFF 0x 00000000 00000000
0xFFFF F0D0 0030 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D0 0038 Scratch Pad Bits OFF 0x 00000000 00000000
OK
Cancel

Event: Digital OFF mask—door on mod 0 pt 0 is open.

Reaction: Digital ON mask—turn on light at mod 1 pt 1.

8. Now choose Event Number 1 from the drop-down list and click Used. In the Event and Reaction sections, enter the Digital ON mask for the closed door and the Digital OFF mask to turn off the light:


Configure Digital Events
Event
Number: 1
Used
Address
Description
Value
EVENT
0xFFFF F0D0 0040 Digital ON 0x 00000000 00000001
0xFFFF F0D0 0048 Digital OFF 0x 00000000 00000000
0xFFFF F0D0 0060 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D0 0068 Scratch Pad Bits OFF 0x 00000000 00000000
REACTION
0xFFFF F0D0 0050 Digital ON 0x 00000000 00000000
0xFFFF F0D0 0058 Digital OFF 0x 00000000 00000020
0xFFFF F0D0 0070 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D0 0078 Scratch Pad Bits OFF 0x 00000000 00000000
OK
Cancel
Event: Digital ON mask—door on mod 0 pt 0 is closed.
Reaction: Digital OFF mask—turn off light at mod 0 pt 0.

9. Click OK.

Both event/reactions are configured.

10. Configure other event/reactions, or return to the PAC Manager main window and click the Save button to save the configuration file.

Configuring Alarms and Reactions

PAC-R EB UIO EIO

A reaction can also be set up as a response to an alarm. You can configure alarms for analog points or digital counters. For example, you could monitor the pressure in a tank and set up an alarm if it rises above a certain level, or you could trigger an alarm when a specific number of boxes on a conveyor have passed through a beam sensor. For each alarm, you configure a suitable reaction.

For analog points, alarms are based on the analog input value. For digital points, alarms are based on the counter value (applies to points on 4-channel digital modules only). For each point, you can configure any or all of the following alarms:

- **Deviation alarm**—sets a range on either side of the current value that is acceptable; beyond that range, the reaction occurs. For example, suppose you are monitoring temperature. If the current value is 80 and you set a deviation limit of 6, the reaction will not occur unless the value drops below 74 or rises above 86.

  NOTE: When a reaction occurs, the deviation limit stays the same, but the value that set off the reaction becomes the new deviation value. In this example, if the temperature drops to 73, the reaction occurs. Six is still the deviation limit, but now 73 is the deviation value; another reaction will not occur unless the value drops below 67 or rises above 79.

- **High-limit alarm**—sets a fixed upper limit. If the analog value or counter is higher than the high limit, the reaction occurs.
- **Low-limit alarm**—sets a fixed lower limit. If the analog value or counter is lower than the low limit, the reaction occurs.

How Alarms Trigger Reactions

Reactions to alarms are edge-triggered, not level-triggered, and when the alarm state changes, the reaction is automatically reversed. The I/O unit sends the reaction just once, as soon as the alarm occurs (at the "edge" of the alarm). The I/O unit does not send the reaction again until the alarm occurs again. If the alarm stops, however, the I/O unit *reverses* the reaction.

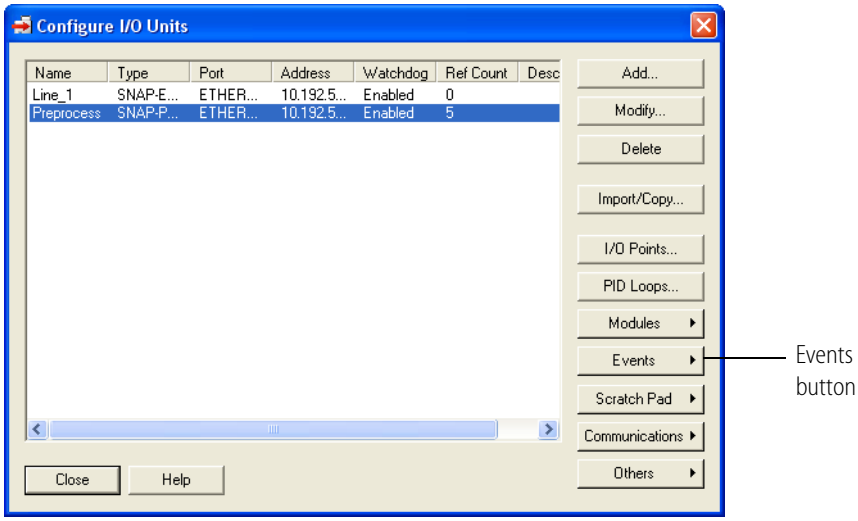
For example, suppose you set up a high-limit alarm that turns on a Scratch Pad bit that will turn on a fan if the temperature goes over 70°. As soon as the alarm state occurs (the temperature goes over 70°), the I/O unit sends the reaction (turns on the bit to turn on the fan). If the temperature remains above 70°, the I/O unit does not continue to turn on the fan bit; the bit just stays on.

When the temperature falls back below the high limit (70° minus whatever deadband you have set), the I/O unit automatically reverses the reaction by turning the Scratch Pad bit off. (To turn the fan off, you would have to set up a reaction for the off bit, turning the fan off.)

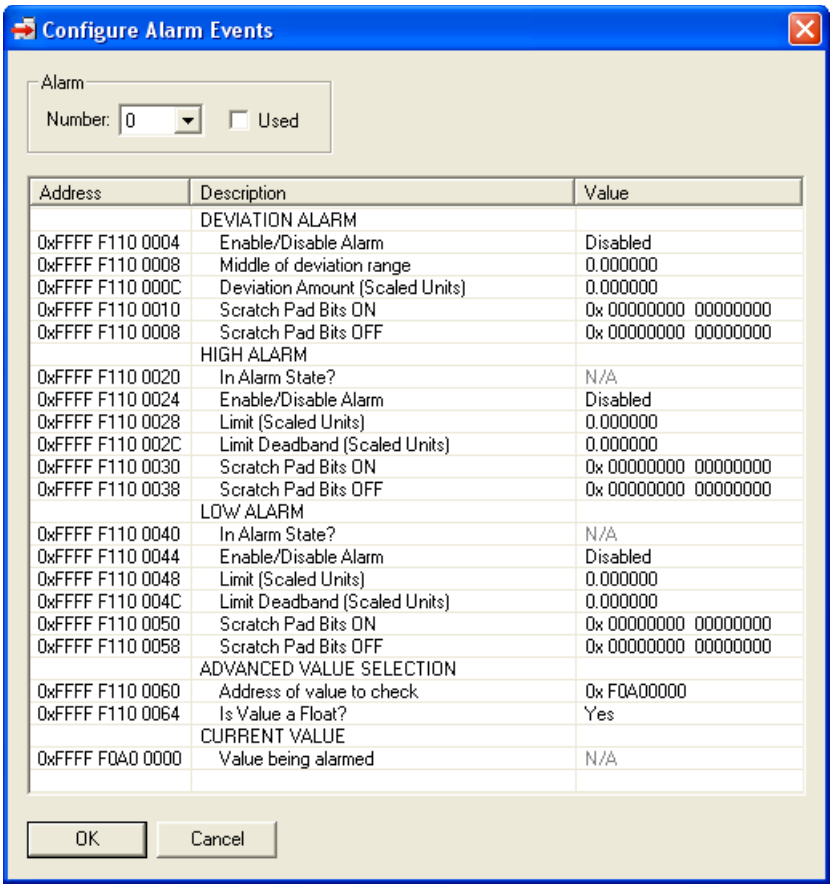
Notice that the reaction and its reversal are absolute; they do not depend on the pre-alarm condition. For example, if the bit to turn on the fan was already on at the time the temperature rose above 70°, the reaction would turn the bit on even though it was already on. When the temperature fell back below 70°, the I/O unit would not return the fan bit to its pre-alarm condition (on); it would turn the bit off.

Example: Alarms Event/Reaction

1. In the PAC Manager main window, with a configuration file open, right-click the name of the I/O unit on which you want to set up alarm events and choose Configure from the pop-up menu.



2. Click the Events button and choose Alarm Events from the pop-up menu.


Configure Alarm Events
Alarm
Number: 0
Used
Address
Description
Value
DEVIATION ALARM
0xFFFF F110 0004 Enable/Disable Alarm Disabled
0xFFFF F110 0008 Middle of deviation range 0.000000
0xFFFF F110 000C Deviation Amount (Scaled Units) 0.000000
0xFFFF F110 0010 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F110 0008 Scratch Pad Bits OFF 0x 00000000 00000000
HIGH ALARM
0xFFFF F110 0020 In Alarm State? N/A
0xFFFF F110 0024 Enable/Disable Alarm Disabled
0xFFFF F110 0028 Limit (Scaled Units) 0.000000
0xFFFF F110 002C Limit Deadband (Scaled Units) 0.000000
0xFFFF F110 0030 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F110 0038 Scratch Pad Bits OFF 0x 00000000 00000000
LOW ALARM
0xFFFF F110 0040 In Alarm State? N/A
0xFFFF F110 0044 Enable/Disable Alarm Disabled
0xFFFF F110 0048 Limit (Scaled Units) 0.000000
0xFFFF F110 004C Limit Deadband (Scaled Units) 0.000000
0xFFFF F110 0050 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F110 0058 Scratch Pad Bits OFF 0x 00000000 00000000
ADVANCED VALUE SELECTION
0xFFFF F110 0060 Address of value to check 0x F0A00000
0xFFFF F110 0064 Is Value a Float? Yes
CURRENT VALUE
0xFFFF F0A0 0000 Value being alarmed N/A
OK
Cancel

3. In the drop-down list, choose the Alarm Number you want to use (by default, it is the same number as the point the alarm will monitor). Click Used.

   The alarm number can be any unused number, but it is best to use the point number, since by default that point's memory map address and value are shown in the Value Being Alarmed field.

   If you need to set two or more alarms on the same point, however, you can do so. For additional alarms, choose a different alarm number, configure the alarm, and enter the memory map address for the point in the Advanced Value Selection section. (A complete list of memory map addresses is in the *OptoMMP Protocol Guide*.)

4. Find the section for the type of alarm you want to use (deviation, high, or low). In the Value column, click the Enable/Disable Alarm cell and choose Enabled from the drop-down list. Click in other cells to set deviation or alarm limits. For high and low alarms, also set the deadband for the limit.

   A deadband is an allowable variation in the limit to account for signal noise. If the signal fluctuates slightly, the deadband limit keeps the I/O unit from sending out another alarm.

5. For each alarm, also configure the reaction in two parts:
   - Scratch Pad bits that should be turned on
   - Scratch Pad bits that should be turned off

See "The Scratch Pad" on page 124.

6. (Optional) If you are setting two or more alarms on the same point, use the Advanced Value Selection area to enter the memory map address for the point to monitor, and indicate whether the value on that point is a float.
7. Repeat from step 3 for additional alarms. When you have finished configuring alarms, click OK.
8. Click the Save button to save the configuration file.

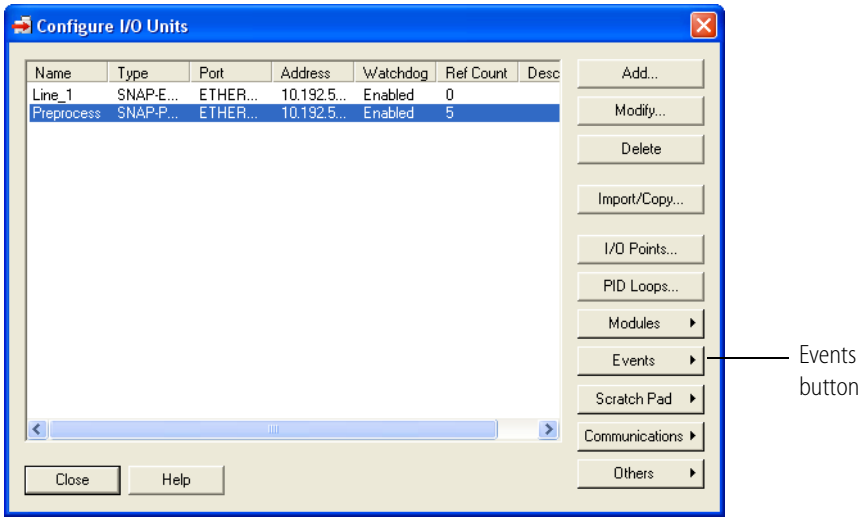
Configuring Serial or Wiegand Events and Reactions

PAC-R
EB
UIO
EIO

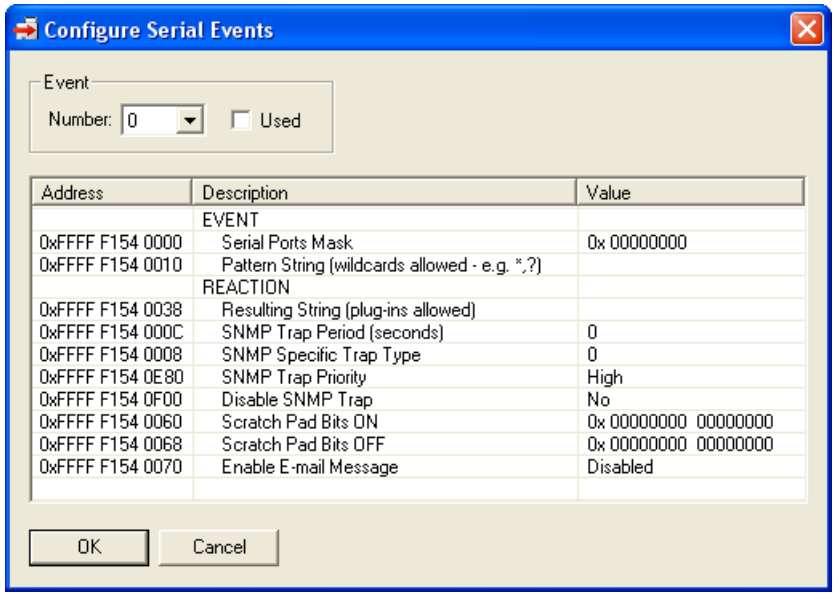
If you are using Opto 22 serial communication modules—RS-232, RS-485/422, or Wiegand—with SNAP PAC, SNAP Ultimate, or SNAP Ethernet I/O units, you can configure a serial or Wiegand event to send a serial message, to send an SNMP trap, or to turn bits in the Scratch Pad on or off when a specific string is received from one or more modules.

Before you configure serial events and reactions, make sure you have configured the serial modules (page 48).

In the PAC Manager main window, with a configuration file open, right-click the name of the I/O unit on which you want to set up serial or Wiegand events and choose Configure from the pop-up menu.



1. Click the Events button and choose Serial Events from the pop-up menu, or if you are configuring events for a Wiegand serial communication module, choose Wiegand Events.



The example above shows the Configure Serial Events dialog box; the Wiegand Events dialog box is similar.

2. In the drop-down list, choose the lowest unused Event Number. Click Used.

NOTE: To reduce scanning time, the I/O unit stops scanning serial events when it reaches an unused event. Make sure you use event numbers in order, starting with the lowest.

3. In the Event section, enter a mask in hex notation indicating the serial ports to monitor.

The I/O unit monitors all ports set as "on" bits in the mask (on = 1; off = 0). If the string is received from *any* of those serial ports, the event triggers the reaction. For example, suppose you have serial modules in positions 1 and 2 on the rack. (Other kinds of modules are in positions 0 and 3.) The following table shows how you might figure out the mask to monitor three of these serial ports:

Module position:	←	3		2		1		0	
Serial port:	←	--	--	B	A	B	A	--	--
Default IP port number:	←	--	--	22505	22504	22503	22502	--	--
Monitor? (Y or N):	←	--	--	Y	N	Y	Y	--	--
Mask (binary notation):	←	0	0	1	0	1	1	0	0
Mask (hex notation):	←	2				C			

The complete hex mask you would enter to monitor these ports is: 0000002C.

4. Enter the pattern string the event should match.

The string is limited to 40 characters. Wildcards (* and ?) can be used.

5. In the Reaction section, do any or all of the following:

a. To send text in an SNMP trap or a one-time email message, complete the Resulting string field.

If you send a string, it is limited to 126 characters.You can place data from the serial module or the I/O unit's memory map into the string by using any or all of the following plugins:

`$!_str_`	Includes the pattern string in the resulting string.
`$!_port_`	Shows which serial port sent the pattern string.
`$!X_YYYYYYYY_`	Includes data from a memory map address. See "Using Plugins" on page 89 for more information.

For example, a resulting string that includes the pattern string, the serial port that sent it, and the text *Overload* would look like this:

```
$!_str_ $!_port_ Overload
```

b. To send an SNMP trap, also enter how often in seconds to send the trap (use zero to send it only once), and enter the trap type. Remember to configure email (page 93).

Trap types are determined by your SNMP management system.

c. To send a one-time email notification, also enable E-mail Message. Make sure to configure email (page 93).

To send multiple emails, don't enable email here. Instead, turn on a Scratch Pad bit (step e) and set up the email when you configure event messages (page 86).

d. To send a serial message out a serial port, don't put the message here. Instead, turn on a Scratch Pad bit (step e) and set up the serial message when you configure event messages (page 86).

e. To set Scratch Pad bits, enter masks for the bits to turn on and the bits to turn off when the serial event occurs.

6. Repeat from step 2 for other serial events and reactions. When you have finished configuring serial events and reactions, click OK.

7. Click the Save button to save the configuration file.

Configuring Timed Events and Reactions

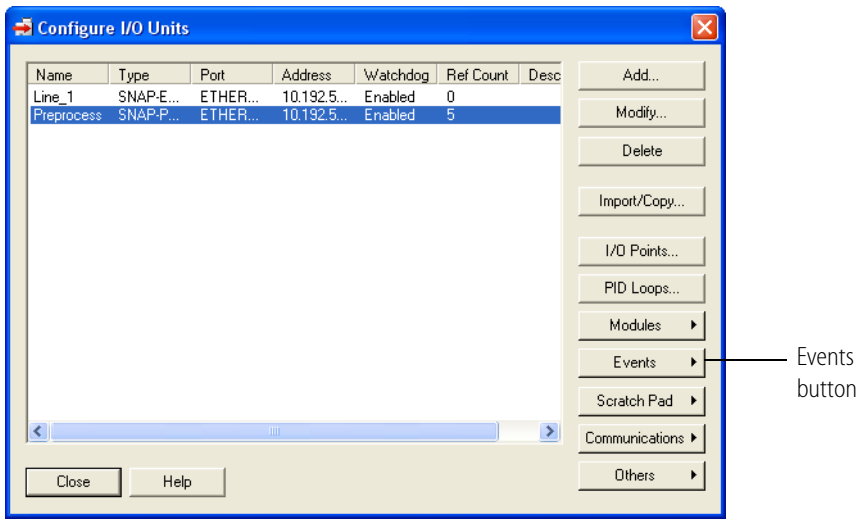
PAC-R
EB
UIO
EIO

Reactions normally occur immediately after their events happen. If you want a delay between an event and its reaction, you can configure a timer.

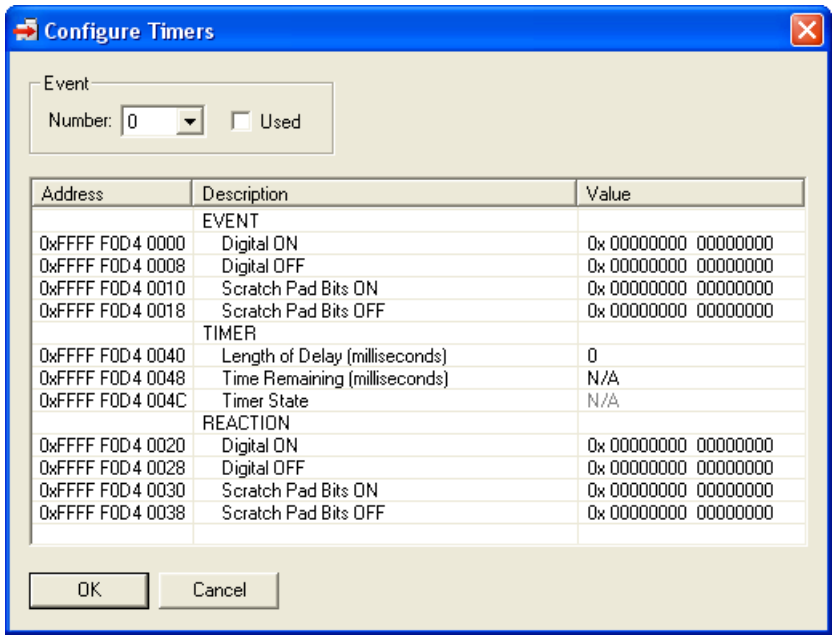
The timer starts timing in response to a digital event or a Scratch Pad bit pattern (or both), waits the length of time you set, and then sets off a digital reaction and/or sets a different Scratch Pad pattern. (Digital events apply to points on 4-channel modules, not on high-density modules.)

Follow these steps to configure a timer:

1. In the PAC Manager main window, with a configuration file open, right-click the name of the I/O unit on which you want to set up timed events and choose Configure from the pop-up menu.



2. Click the Events button and choose Timer Events from the pop-up menu.


Configure Timers
Event
Number: 0
Used
Address
Description
Value
EVENT
0xFFFF F0D4 0000 Digital ON 0x 00000000 00000000
0xFFFF F0D4 0008 Digital OFF 0x 00000000 00000000
0xFFFF F0D4 0010 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D4 0018 Scratch Pad Bits OFF 0x 00000000 00000000
TIMER
0xFFFF F0D4 0040 Length of Delay (milliseconds) 0
0xFFFF F0D4 0048 Time Remaining (milliseconds) N/A
0xFFFF F0D4 004C Timer State N/A
REACTION
0xFFFF F0D4 0020 Digital ON 0x 00000000 00000000
0xFFFF F0D4 0028 Digital OFF 0x 00000000 00000000
0xFFFF F0D4 0030 Scratch Pad Bits ON 0x 00000000 00000000
0xFFFF F0D4 0038 Scratch Pad Bits OFF 0x 00000000 00000000
OK
Cancel

3. In the drop-down list, choose the lowest unused Event Number. Click Used.

NOTE: To reduce scanning time, the I/O unit stops scanning timers when it reaches an unused timer number. Make sure you use timer numbers in order, starting with the lowest.

4. In the Event section, enter the digital event and/or Scratch Pad masks that should start the timer. (For help in using the Scratch Pad, see page 124.)

5. In the Timer section, enter the length of the timer delay, in milliseconds.

   For example, for a 10-second delay between the event and the reaction, enter 10,000.

6. In the Reaction section, enter the digital reaction that should occur and/or the Scratch Pad masks that should be set when the timer expires.
7. Repeat from step 3 for additional timers. When you have finished configuring timed events and reactions, click OK.
8. Click the Save button to save the configuration file.

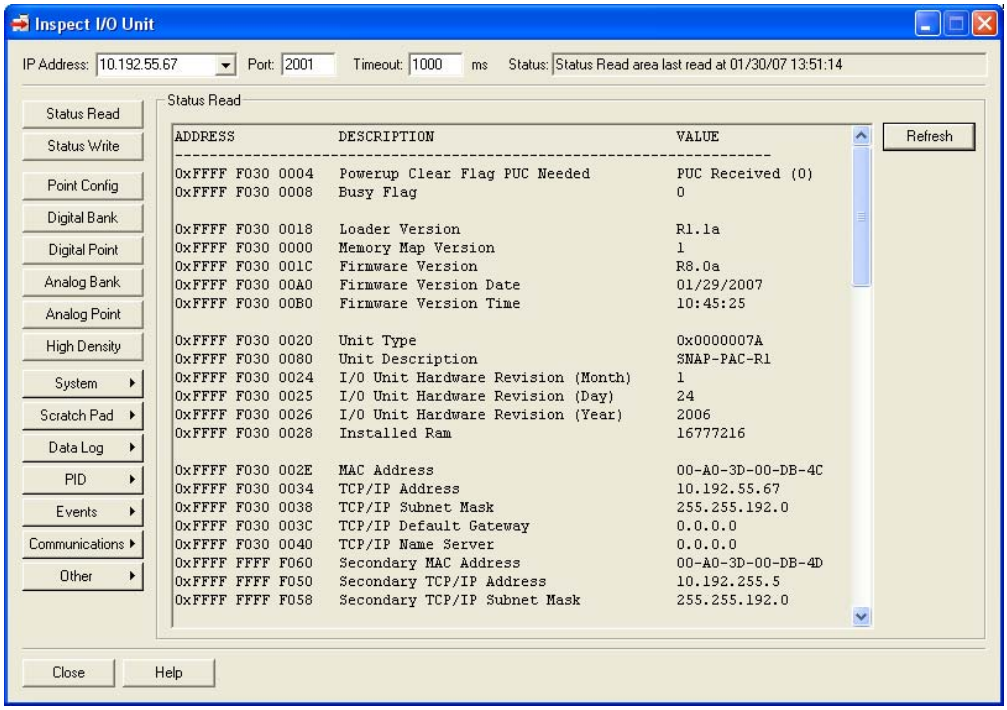
Configuring Event Messages

PAC-R
EB
UIO
EIO

If you are using PAC Control, do not use this section; configure event messages in the configuration file as shown on page 86.

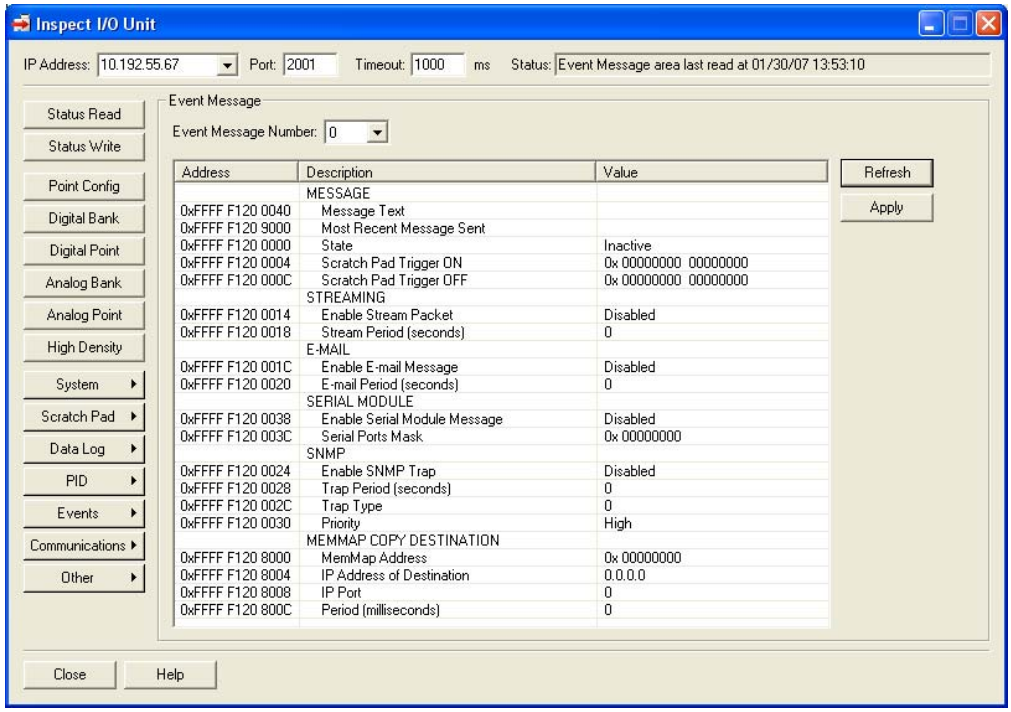
If you are not using PAC Control, you cannot configure event messages in a configuration file. Instead, use PAC Manager's Inspect mode and follow the steps below.

1. In the PAC Manager main window, click the Inspect button .


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Close
Help

If you have used the Inspect button before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the I/O unit (or choose it from the drop-down list). Click Events and choose Event Messages from the submenu.



3. From the drop-down list, choose the lowest unused message number.

   Unused message numbers have no asterisk.

4. For an email or serial message, or optionally for an SNMP message, enter the message text.

   Message text is not sent in the streaming packet. Message text is limited to 127 characters. You can place data from the I/O unit's memory map into the message by using a plugin (see page 89). If you are sending a serial message, make sure the text is formatted so the serial device that receives it will understand it.

5. Enter two masks indicating the Scratch Pad on and off bits that should trigger the message.

   For help in figuring out the masks, see "Digital Point and Scratch Pad Masks" on page 128.

6. Streaming section: To send a stream of data as the message, choose Enabled from the drop-down list. Enter how often in seconds to send the stream (0 sends it only once).

   For information on streaming, see page 98.

7. E-mail section: To send an email message, choose Enabled from the drop-down list. Enter how often in seconds to send the email (0 sends it only once).

8. Serial Module section: To send a message through a serial module to a serial device, choose Enabled from the drop-down list. Enter a mask representing the modules and ports to receive the message.

   Information in "Configuring Serial or Wiegand Events and Reactions" on page 136 may be helpful.

9. SNMP section: To send an SNMP trap as the message, change Disabled to Enabled. Enter how often to send the trap (0 sends it only once). Also enter the trap type (determined by your SNMP management software). If you are using SNMP with outgoing PPP and want the trap stored in the I/O unit until the next communication, set Priority to Low. If you want the I/O unit to immediately dial out and send the trap, set Priority to High.

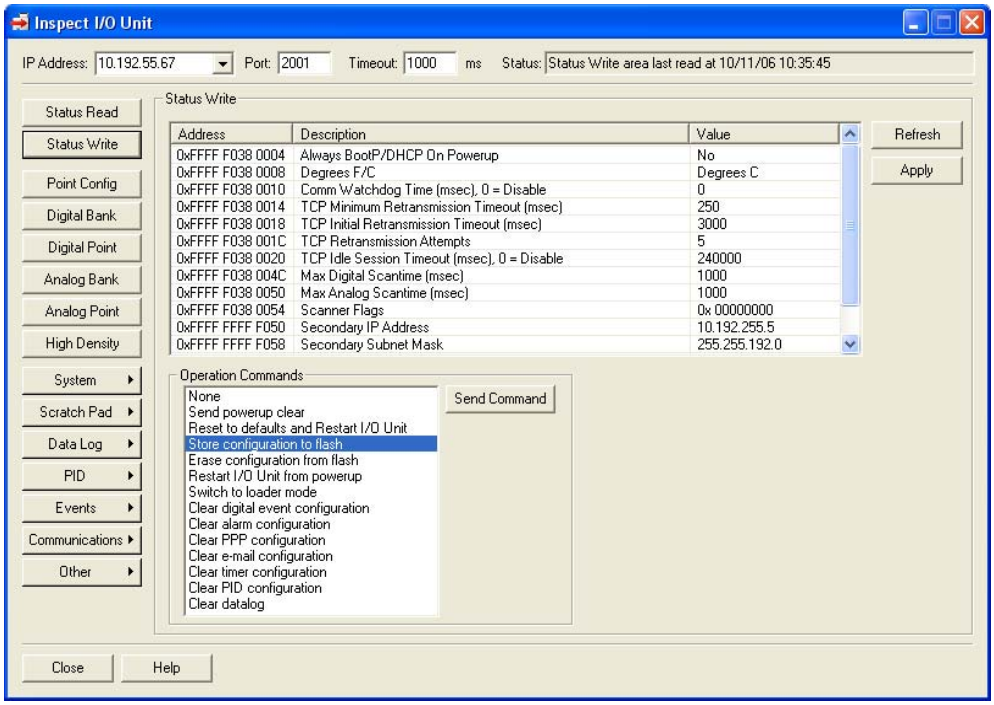
   For information on SNMP, see page 90.

   NOTE: SNMP messages must be acknowledged. You can do so in your application or in PAC Manager's Inspect window: in the Message section, change the State to Acknowledge and click Apply.

10. Memmap Copy Destination section: To copy memory map data, complete this section using information from "Copying Memory Map Data" on page 103.
11. When all fields are correct, click Apply.
12. Repeat from step 3 to configure additional event messages.
13. For each type of message you configure, make sure you also set up basic configuration:

    Streaming: page 98 Serial: page 48
    Email: page 93 SNMP: page 90

14. When you have finished configuring all event messages and any additional configuration required for them, in the PAC Manager Inspect window, make sure the IP address shown is the correct one. Then click the Status Write button in the upper-left part of the window.
15. In the Operation Commands list, highlight Store configuration to flash.



16. Click Send Command.

The configuration data is stored to flash memory and a Success message appears.

IMPORTANT: *For the following configurations, you must also restart the unit in order for configuration to take effect:*

Changes in IP port for serial modules
Email configuration
Data logging interval
SNMP configuration
PPP configuration

17. If you have configured any of these items, in the Operation Commands list, highlight Restart I/O Unit from powerup. Click Send Command.

The I/O unit is restarted and a success message appears.

Reading and Writing to Specific Devices

Introduction

This chapter shows you how to read and write to an Ethernet-based controller or I/O unit directly by using PAC Manager's Inspect window. In addition to reading and writing specific values, you can configure points and functions using the steps in this chapter. However, **these configurations cannot be saved to a configuration file.**

Because all reads and writes using the steps in this chapter are sent directly to the controller or I/O unit, the device you are reading from or writing to must be on the same network as your PC.

CAUTION—If you are using PAC Control: *When you read and write to specific devices using the instructions in this chapter, the reads and writes occur independently of PAC Control strategy logic. If you are using PAC Control, you normally use the flowchart logic in the PAC Control strategy to read and write to the I/O unit. It's not a problem to read directly, but if you use the instructions in this chapter to write to an I/O unit, be very careful that your actions do not conflict with PAC Control logic.*

As you use PAC Manager's Inspect window, you'll notice that the starting memory map address for each item is shown. This can be a handy way to determine addresses you need for programming or configuration. You can also highlight an address and right-click it to copy it; then you can paste it where you are using it.

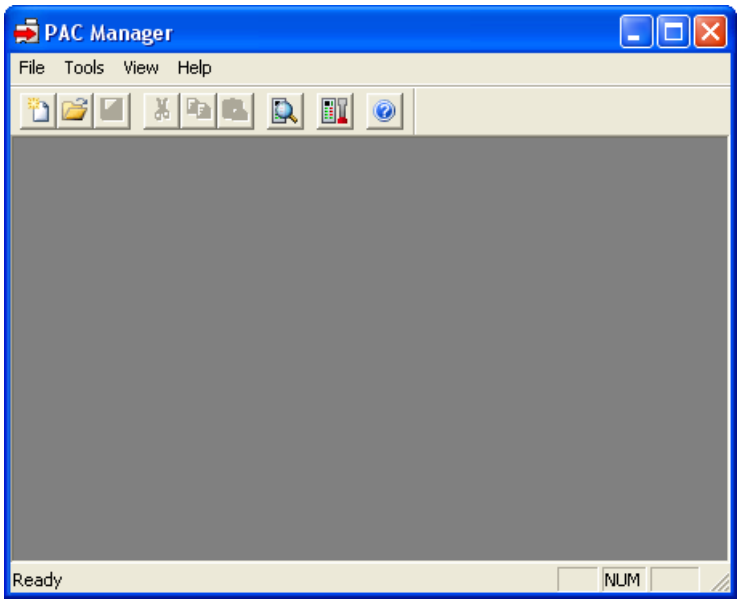
You can also copy and paste part or all of the data you read in the Inspect window. Just highlight the data you want to copy and use standard Microsoft® Windows® commands such as CTRL-C to copy the data and paste it into a text, email, or other file.

Reading Basic Device Information

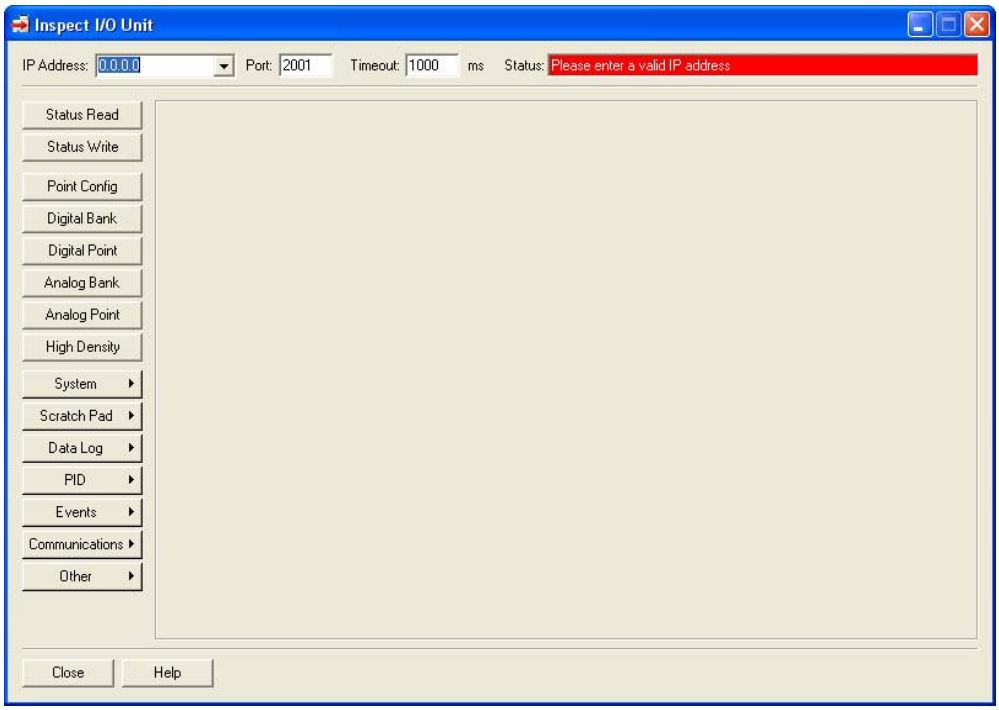
PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

1. If PAC Manager is not already open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

   The PAC Manager main window opens:



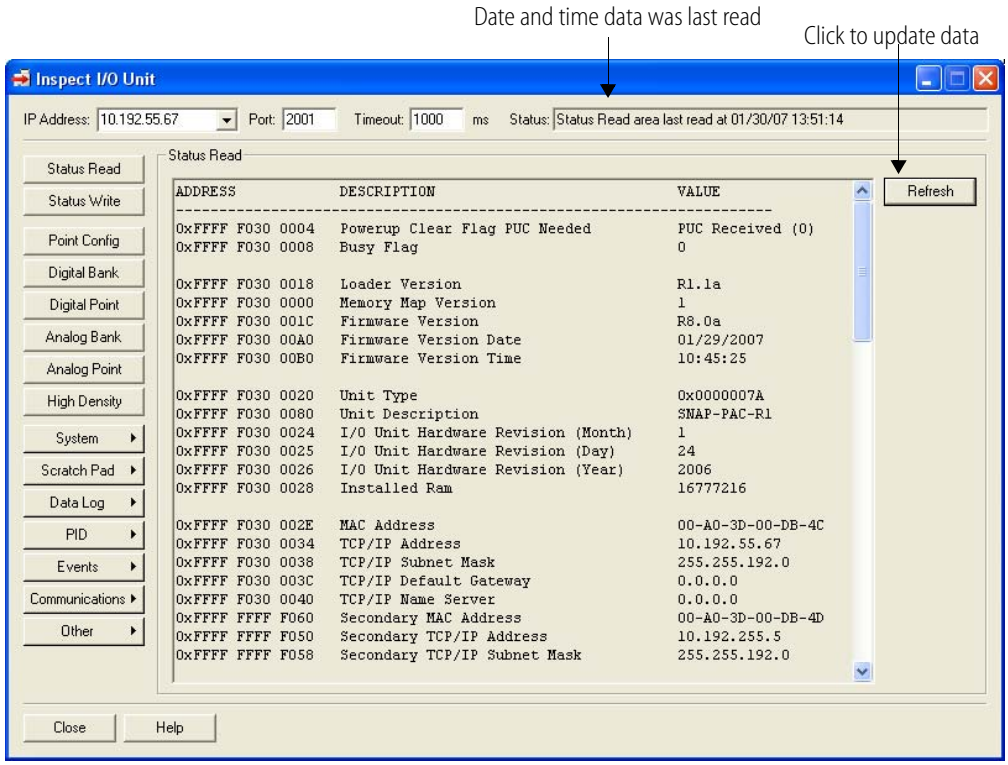
2. In the PAC Manager main window, click the Inspect button (or choose Tools→Inspect).



If this is the first time you have used the Inspect window, the IP address will show 0.0.0.0, as shown above. If you have used the Inspect window before, the last IP address you used is shown, and the most recently used IP addresses are available in the drop-down list.

3. In the IP Address field, type the IP address of the controller or I/O unit (or choose it from the drop-down list). Click Status Read.

Information from the device is displayed in the window:


Date and time data was last read
Click to update data
Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000
ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Close
Help

Scroll down to see all of the information. Data is current as of the date and time shown in the Status field at the top right corner of the window. (Note that date and time are from the PC, not from the I/O unit.) To update data, click the Refresh button. See the next two pages for help in interpreting data.

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

Interpreting Status Data

The following table may help you interpret the information you see in the Status Read window. Some items may not appear, depending on the Opto 22 device you are using. Some of this information can be changed (see page 151). Much of it is used only for troubleshooting. If you have additional questions about status data, contact Product Support (see page 3).

The term "device" is used in this table to refer to a SNAP Ethernet-based I/O unit, E1 or E2 brain board, or SNAP PAC controller.

Description	Explanation
Powerup Clear Flag PUC needed	Since a powerup clear (PUC) is automatically sent by the device whenever it is turned on, this value should show PUC Received.
Busy Flag	A zero means the device is not busy and can process your requests.
Loader Version	Revision number of the device's loader. The loader is like a basic input/output system (BIOS).
Memory Map Version	Revision number of the device's memory map
Firmware Version	Revision number of the device's firmware, and the date and time of the revision
Firmware Version Date	
Firmware Version Time	
Unit Type	Hex code indicating the device type.
Unit Description	Part number of the device (brain, brain board, or controller)
I/O Unit Hardware Revision (Month)	Version date of the device's hardware
I/O Unit Hardware Revision (Day)	
I/O Unit Hardware Revision (Year)	
Installed Ram	Number of bytes of RAM in the device
MAC Address	Unique hardware Media Access Control (MAC) identifier for the device, assigned at the Opto 22 factory. MAC addresses for all Opto 22 devices start with 00-A0-3D.
TCP/IP Address	IP address, subnet mask, and default gateway for the device on the Ethernet network. You assign these numbers; see page 10.
TCP/IP Subnet Mask	
TCP/IP Default Gateway	
TCP/IP Name Server	Not currently used; leave at 0.0.0.0
Secondary MAC Address	(SNAP PAC controllers only) Unique hardware Media Access Control (MAC) identifier for the second Ethernet interface on the device.
Secondary TCP/IP Address	IP address, subnet mask, and default gateway for the second Ethernet interface on the device. You assign these numbers; see page 10.
Secondary TCP/IP Subnet Mask	
Secondary TCP/IP Default Gateway	
Secondary TCP/IP Name Server	Not currently used; leave at 0.0.0.0

Description	Explanation
Host Name	(E1 and E2 only) The device's current host name. See "E1 and E2 brain boards" on page 11 for more information on host names.
Domain Name	(E1 and E2 only) If you are using host names, the domain name for the device. See "E1 and E2 brain boards" on page 11.
Previous Command Error Code	Significant if you are writing your own applications for an I/O unit. See the *OptoMMP Protocol Guide* (Opto 22 form #1465) for error information.
Previous Command Error Address	
Previous Command Source Address	
Previous Command Transaction Label	
Always BootP/DHCP On Powerup	A value of 0 (the normal setting) means the device sends a request (a BootP or DHCP request) for an IP address only if its IP address is 0.0.0.0. A value of 1 means the device sends a BootP or DHCP request every time it is turned on. See page 10 for more information.
Degrees F/C[1]	Whether temperatures on the I/O unit are handled in Farenheit or Celsius. Set when you configure the I/O unit (page 36). Celsius is the default.
Comm Watchdog Time (msec.)[1]	If the I/O unit has a watchdog, the watchdog timeout in milliseconds. Set when you configure the I/O unit (page 36). Default is 0 (no watchdog).
Scanner Flags	Shows scanner and control engine options. Value can be any of the following or a combination of them, in hex. See "Scanner Flags" on page 152 for more information. 1 = Alarms are being processed in the digital scanner rather than the analog scanner.[1,2] 2 = Analog scanner is disabled.[1,2] 4 = Digital scanner is disabled.[1,2] 8 = (applies to all standalone and on-the-rack controllers) PAC Control engine is stopped.
Digital Scan Counter[1,2]	Shows the number of times the processor (brain or on-the-rack controller) has scanned the digital points on the I/O unit. Can be used for benchmarking.
Analog Scan Counter[1,2]	Shows the number of times the processor has scanned the analog points on the I/O unit. Can be used for benchmarking.
Milliseconds Since Powerup[2]	Milliseconds since the last time the device was turned on.
TCP Minimum RTO (msec.)[2]	TCP communication settings; see page 214.
TCP Initial RTO (msec.)[2]	
TCP Retransmits[2]	
TCP Idle Session Timeout (msec.)[2]	
TCP Idle Session Timeout Count[2]	Number of times the device closed the session because it was idle.
Ethernet Errors: Late Collisions[2]	Values other than 0 may indicate network problems. See page 215.
Ethernet Errors: Excessive Collisions[2]	
Ethernet Errors: Others[2]	

Description	Explanation
Smart Modules Present[1,2]	Mask in hex showing location of analog, serial, high-density digital, and PID modules on the rack. Module 15 is in bit position 15; module 0 is in bit position 0. (For help in understanding masks, see "Mask Data" on page 190.)
PID Loops available[1,2]	(PAC-R, PAC EB brains, UIO, and EIO only) Maximum number of PID loops possible on the device (96 on PAC-R, 32 on PAC EB brains, UIO, 16 on EIO). See page 61.
Arcnet Reconfigs Detected[1,2]	Indicates that a smart module has been added, removed, or reset. (ARCNET is used on the rack for communication between the processor and analog, serial, high-density digital, or PID modules.) NOTE: If the rack contains only 4-channel digital modules, ignore this value.
Arcnet Reconfigs Initiated by I/O Unit[1,2]	Error on the rack's ARCNET bus. Not a concern unless it happens frequently.
Arcnet Transmit Attempts Since Powerup[1,2]	Refers to the ARCNET bus on the rack. May be useful in troubleshooting communication to analog, serial, high-density digital, and PID modules.
Arcnet ACKs[1,2]	
Arcnet Timeouts[1,2]	
Arcnet Other (node not found, etc)[1,2]	
Arcnet Timeout Value (msec.)[1,2]	
Arcnet Receive Interrupts[1,2]	
Ethernet MAC Resets Since Powerup[2]	Caused by EMI, RFI, or other electrical noise.
Dig. Output Point Resets Since Powerup[1,2]	
Dig. Interrupt Failures Since Powerup[1,2]	Related to digital counters. May have missed counts. Contact Opto 22 Product Support.
MilliSeconds Per Analog Scan[1,2]	Average length of time the processor takes to scan all analog and high-density digital points on the rack. Based on the last 100 scans (last 50 scans for points on high-density digital modules, as they are included in every second scan). A value of -1 means the scanner is not running.
MilliSeconds Per Digital Scan[1,2]	Average length of time the processor takes to scan all 4-channel digital points on the rack, based on the last 100 scans. A value of -1 means the scanner is not running.
Module X - Times Discovered[1,2]	How many times the processor has rediscovered a smart module (analog, serial, high-density digital). Normal value is zero; values over 1 may indicate that a module is resetting.

1 Does not apply to SNAP PAC S-series controllers
2 Does not apply to E1 and E2 brain boards

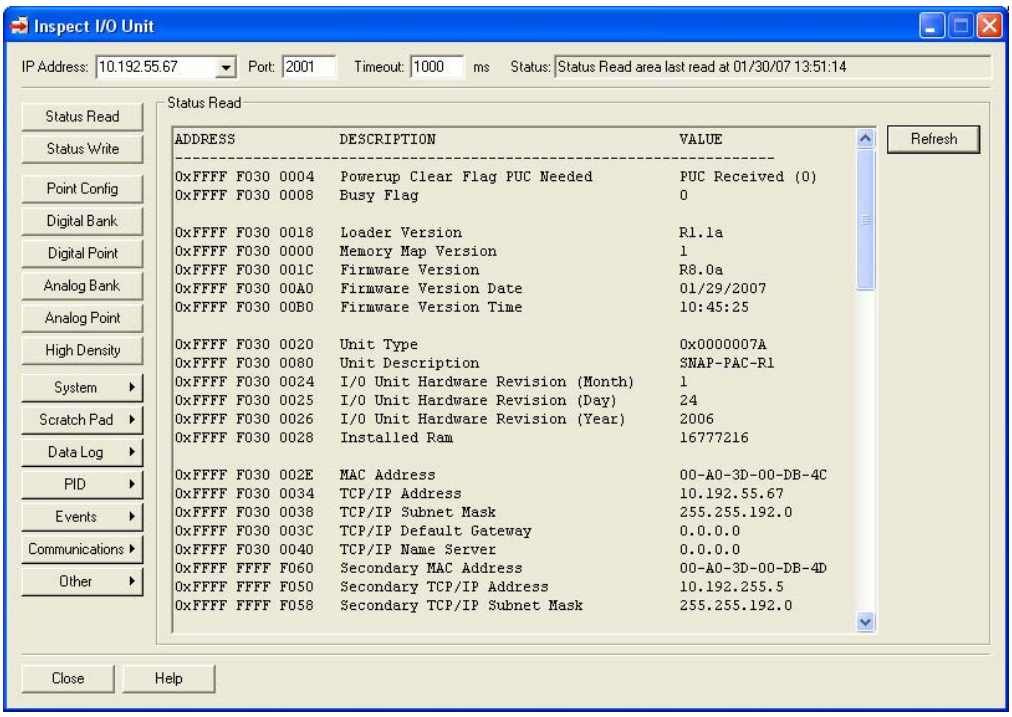
PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

Changing Status Data

The following items in the Status Read window can be changed in PAC Manager if the device supports them.

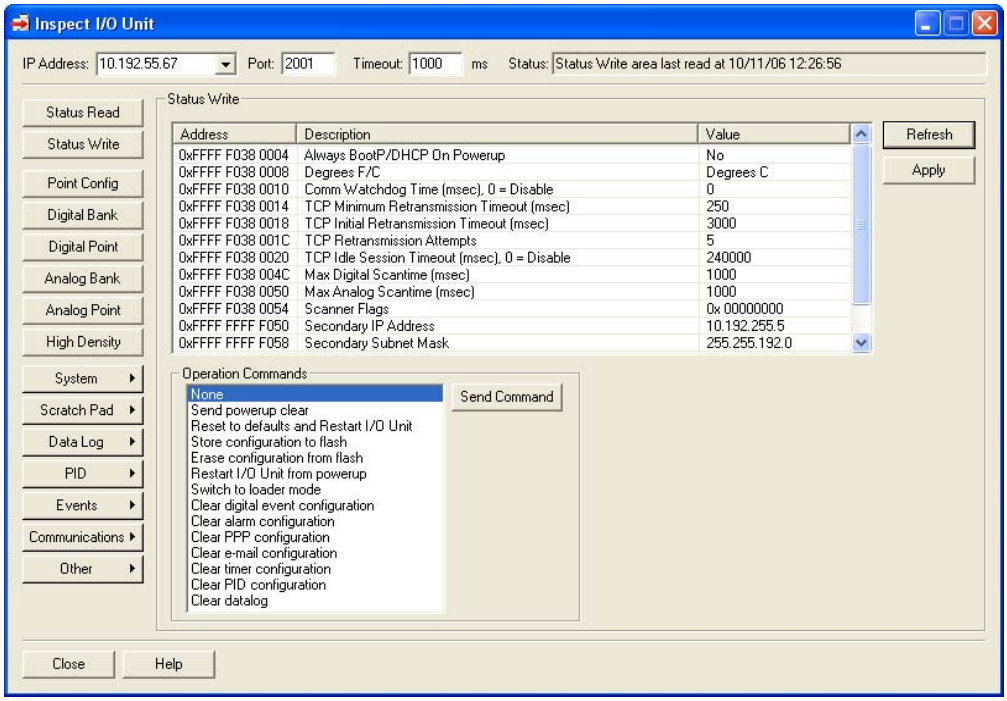
Secondary TCP/IP Address
Secondary TCP/IP Subnet Mask
Secondary TCP/IP Default Gateway
Secondary TCP/IP Name Server
Always BootP/DHCP on Powerup
Degrees F/C
Comm Watchdog Time
TCP Settings
Max Digital Scantime
Max Analog Scantime
Scanner Flags
Host name

1. In the PAC Manager main window, click the Inspect button .


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Close
Help

If you have used the Inspect button before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the device (or choose it from the drop-down list).
3. Click Status Write.



4. Items that can be changed are listed in the upper section of the dialog box. To change one, click its Value field and either choose from the drop-down list or enter the new value as described below:

Always BootP/DHCP on Powerup (All devices): If you change this field to Yes, the current IP address becomes temporary and the device will send a BootP or DHCP broadcast the next time it is turned on. If you change this field to No, the current IP address is saved to flash memory and becomes a static IP address.

Degrees F/C and **Comm Watchdog Time** (I/O units only): Changes settings for the whole I/O unit.

TCP settings (All devices except E1 and E2): *CAUTION:* Before changing TCP settings, see page 214.

Max Digital and **Analog Scantimes** (PAC-R, UIO, EIO, and SIO only): Default for each is 1000 msec. You can increase the scan time to make sure the scanner isn't slowed or stopped by heavy communication on the network. (This is not a problem for E1s and E2s because they scan differently.) You can also shut down the scanner immediately by changing its scantime value to -1 (does not require restarting the I/O unit). Note that scantime changes revert to default values when power is lost, unless you save to flash.

Scanner Flags: To change the way scanners work or stop/start the control engine, enter one or a combination of the following values in hex.

- (PAC-R, UIO, EIO, and SIO only) To process alarms in the digital scanner rather than the analog scanner, enter 1.
- (PAC-R, UIO, EIO, and SIO only) To disable the analog scanner, enter 2.
- (PAC-R, UIO, EIO, and SIO only) To disable the digital scanner, enter 4.

– (PAC-S, PAC-R, and UIO only) To stop the PAC Control engine runtime, enter 8.

For example, if you have a SNAP-PAC-R1 I/O unit with digital I/O only and are not using a PAC Control strategy, you can get faster reactions to events by entering 1 + 2 + 8, which would be 0x0000000B.

Host name (E1s and E2s only): The I/O unit's host name can be changed here. The host name can include letters, numbers, and minus signs (hyphens). The first character must be a letter and the last letter must be a letter or a number. Host names are not case sensitive and can be from two to 63 characters long. See "E1 and E2 brain boards" on page 11 for more information on host names.

Secondary IP Address information (SNAP PAC controllers only): See "Assigning a Secondary IP Address (SNAP PAC Controller Only)" on page 28 for information.

5. When you have finished entering changes, click Apply.

   Most changes take effect immediately. If you change the Scanner Flags or secondary IP address information, however, you must **store the configuration to flash and then restart** the controller or brain. Also see "Assigning a Secondary IP Address (SNAP PAC Controller Only)" on page 28.

Referencing I/O Points

PAC-R
EB
UIO
EIO
SIO
E1
E2

The following sections show input and output point numbers for I/O units.

For **SNAP serial communication modules**, see page 155. You will also need Opto 22 form 1191, *SNAP Serial Communication Module User's Guide*.

CAUTION:** Make certain you are using the correct rack for the processor.* ***Using an incompatible rack can cause severe damage to the brain or controller.

To reference I/O points, see the section for the rack you are using:

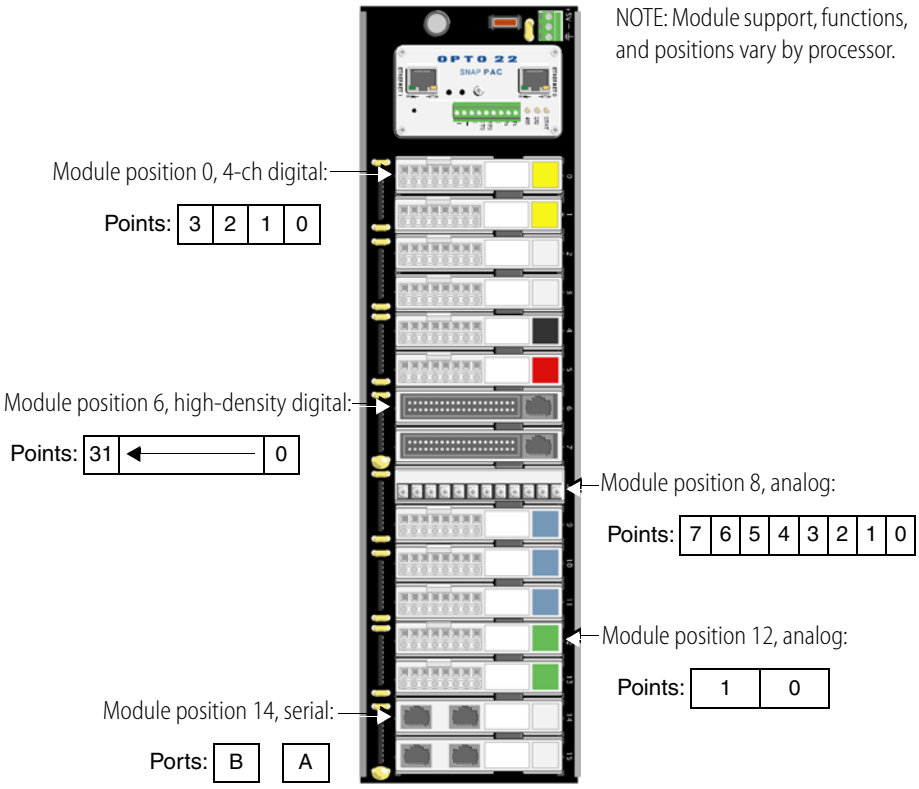
SNAP PAC rack (SNAP-PAC-RCK4, SNAP-PAC-RCK8, etc.)	SNAP-PAC-R1 SNAP-PAC-R2	see page 154
SNAP M-series rack (SNAP-M16, SNAP-M64, etc.)	SNAP-UP1-M64 SNAP-ENET-S64	
SNAP B-series rack (SNAP-B4M, SNAP-B8MC, SNAP-B12MC-P, SNAP-B16M, etc.)	SNAP-UP1-ADS SNAP-B3000-ENET SNAP-ENET-RTC	see page 155
SNAP-D64RS rack	SNAP-UP1-D64 SNAP-ENET-D64	see page 155
Racks for G4, G1, or Quad Pak digital modules	E1	see page 157
Racks for G1 analog modules	E2	see page 157

SNAP PAC Racks

Rack part numbers	Compatible processors
SNAP-PAC-RCK4 (or SNAP-M16) SNAP-PAC-RCK8 (or SNAP-M32) SNAP-PAC-RCK12 (or SNAP-M48) SNAP-PAC-RCK16 (or SNAP-M64)	SNAP-PAC-R1 SNAP-PAC-R2 SNAP-PAC-EB1 SNAP-PAC-EB2 SNAP-ENET-S64 SNAP-UP1-M64

SNAP PAC mounting racks can hold up to 4, 8, 12, or 16 Opto 22 SNAP I/O modules. Point features and modules supported vary by processor; see the processor's data sheet for specifications.

Each module contains 1 to 32 points (channels), depending on the module. Examples of modules are shown in the following diagram.

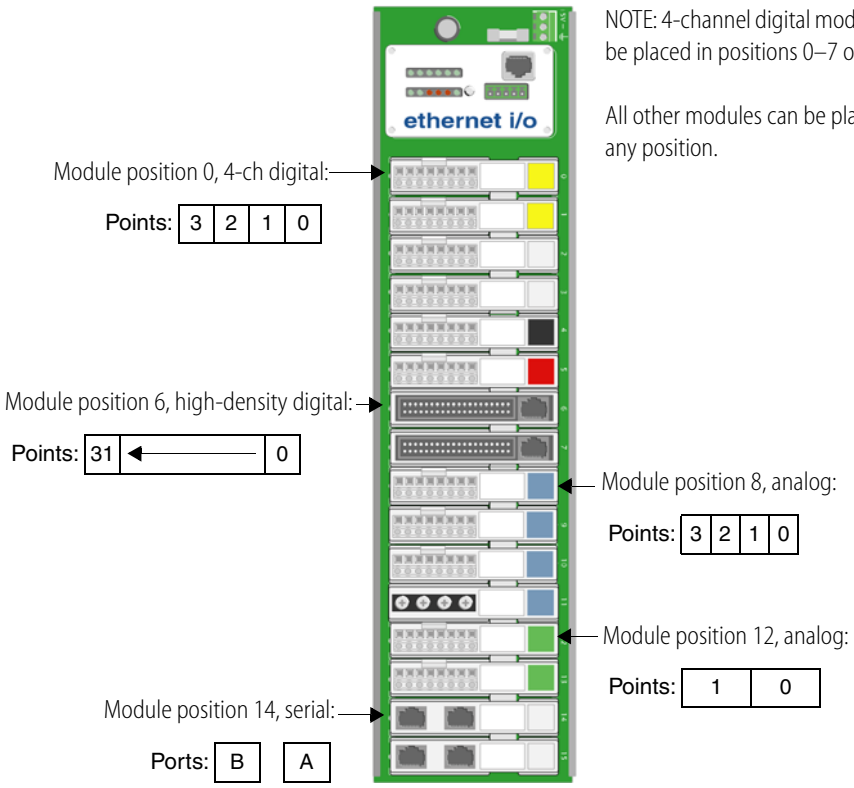

NOTE: Module support, functions, and positions vary by processor.
Module position 0, 4-ch digital:
Points: 3 2 1 0
Module position 6, high-density digital:
Points: 31 0
Module position 8, analog:
Points: 7 6 5 4 3 2 1 0
Module position 12, analog:
Points: 1 0
Module position 14, serial:
Ports: B A

SNAP B-Series Racks

Rack part numbers			Compatible processors
SNAP-B4 SNAP-B8 SNAP-B12 SNAP-B16	SNAP-B8MC SNAP-B12MC SNAP-B16MC	SNAP-B8MC-P SNAP-B12MC-P SNAP-B16MC-P	SNAP-UP1-ADS SNAP-B3000-ENET SNAP-ENET-RTC

NOTE: SNAP B-series racks and the processors compatible with them are not recommended for new development. Use SNAP PAC racks and processors instead.

SNAP B-series mounting racks can hold up to 4, 8, 12, or 16 Opto 22 SNAP I/O modules. Analog, serial, and high-density digital modules (digital modules with more than four points) can be placed in any position. For the larger racks, 4-channel digital modules can be placed in positions 0–7 only. Each module contains 1 to 32 points (channels), depending on the module. Examples of modules are shown in the following diagram.


NOTE: 4-channel digital modules can be placed in positions 0–7 only.
All other modules can be placed in any position.
ethernet i/o
Module position 0, 4-ch digital:
Points: 3 2 1 0
Module position 6, high-density digital:
Points: 31 0
Module position 8, analog:
Points: 3 2 1 0
Module position 12, analog:
Points: 1 0
Module position 14, serial:
Ports: B A

SNAP Digital-Only Rack

NOTE: Digital-only racks and processors are not recommended for new development. Use SNAP PAC racks and processors instead.

The SNAP-D64RS mounting rack is compatible with SNAP-UP1-D64 and SNAP-ENET-D64 processors. The rack holds up to16 4-channel SNAP digital I/O modules. Analog, serial, and high-density digital modules are not supported. Module position 0 is the position closest to the processor.

Serial Modules

The following table applies to these I/O units only:

SNAP-PAC-R1
SNAP-PAC-R2
SNAP-PAC-EB1
SNAP-PAC-EB2
SNAP-B3000-ENET
SNAP-ENET-S64
SNAP-UP1-ADS
SNAP-UP1-M64
SNAP-ENET-RTC

SNAP-SCM-232, SNAP-SCM-485, SNAP-SCM-485-422, and SNAP-SCM-W2 modules each have two serial ports, A and B. Profibus modules (SNAP-SCM-PROFI) have one serial port.

To establish an Ethernet connection between the I/O unit and a serial module, you use the IP address of the I/O unit the module is on, plus the IP port number for the module's serial port. The following table shows default port numbers for each port in each position on the largest rack. For a Profibus module, use the Port A port number.

Module Position	Port	IP Port Number
0	A	22500
	B	22501
1	A	22502
	B	22503
2	A	22504
	B	22505
3	A	22506
	B	22507
4	A	22508
	B	22509
5	A	22510
	B	22511
6	A	22512
	B	22513
7	A	22514
	B	22515

Module Position	Port	IP Port Number
8	A	22516
	B	22517
9	A	22518
	B	22519
10	A	22520
	B	22521
11	A	22522
	B	22523
12	A	22524
	B	22525
13	A	22526
	B	22527
14	A	22528
	B	22529
15	A	22530
	B	22531

These port numbers can be changed if necessary. See page 48 for instructions.

E1
E2

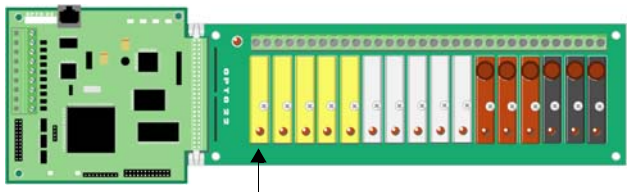
E1 and E2 Brain Boards

When you use PAC Manager or the memory map with E1s and E2s, each module on the E1 or E2 corresponds to the *first point* on a similar SNAP module.

E1 brain boards can be used with a variety of modules. The maximum number of points is 16 on the largest rack, as shown at right.

E1 shown with G4 modules

Since each module has just one point, use only the first point for each module in the memory map.

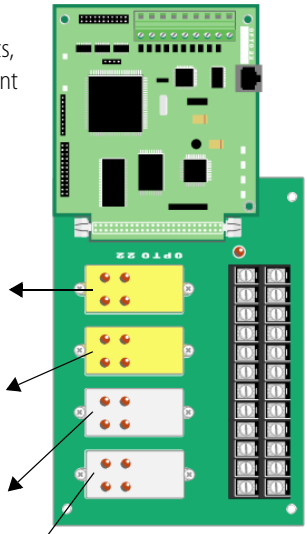


Module position 0

E1 with Quad Pak modules

Quad Pak modules have four input or four output points, but each point is treated as if it were a separate one-point module.

Module position on Quad Pak rack	Module number	Point number
0	0 1 2 3	0 0 0 0
1	4 5 6 7	0 0 0 0
2	8 9 10 11	0 0 0 0
3	12 13 14 15	0 0 0 0



E2 brain boards are used with analog G1 modules only. The largest rack (shown at right) holds 16 single-point modules.

E2 with G1 modules

Since each module has just one point, use only the first point for each module in the memory map.

Module position 0

Configuring I/O Modules, Points, and Features

PAC-R
EB
UIO
EIO
SIO

Before you can read or write to I/O points, you must configure point types and point features. You can do so using PAC Manager's Inspect window. Remember, however, that configurations you set in the Inspect window cannot be saved to a configuration file. They are sent directly to an individual I/O unit. To use a configuration file, see Chapter 2, "Configuring Devices," especially "Configuring I/O Modules and Points" on page 39.

NOTE: For E1 and E2 I/O units, if you are communicating with them using Optomux only, you do not need to configure them in PAC Manager. However, if you are also communicating with E2 I/O units using OptoMMP, Modbus/TCP, or PAC Project software (including OptoOPCServer), you must configure them. To configure E1 and E2 I/O units, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

Point Types Requiring Configuration

For point types, configuration requirements vary based on the type of processor.

SNAP PACs, SNAP Ultimate, SNAP Ethernet, and SNAP Simple I/O processors with analog capability. The processor can recognize analog, serial, and high-density digital modules, and it assumes a default configuration for all points on those modules. Any module position not occupied by an analog, serial, or high-density module is assumed to be a 4-channel digital input module.

For these processors, you must configure the following point types:

- All digital output points on 4-channel digital modules. Use point type 180.
- Analog points that do not use the default point type for the module. For example, if the points on a SNAP-AIRTD module are 120 Ohm Nickel 3-wire RTDs (–80 to +260 °C), they must be configured, because the default for that module is 100 Ohm Platinum 3-wire RTDs (–200 to +850 °C). Point types for analog modules are shown in the tables beginning on page 162. Default point types are indicated.

Digital-only SNAP Ethernet-based brains and E1 brain boards. The brain or brain board assumes that all points are digital input points. You must configure all digital output points with point type 180.

E2 brain boards. You must configure point types for all points on the rack. Follow the instructions in Opto 22 form #1576, *I/O Configuration for E1 and E2 Brain Boards*. If points are not configured following the steps in form #1576, points on E2s will return only `-NAN` (not a value). Point types are shown in the tables beginning on page 162.

Point Features Requiring Configuration

Point features vary based on the processor and the module. The following point features are not automatic and must be configured for each point that uses them:

- High-speed digital input counters and quadrature counters
- Digital and analog watchdogs
- Analog scaling, clamping, offset and gain, and average filter weight

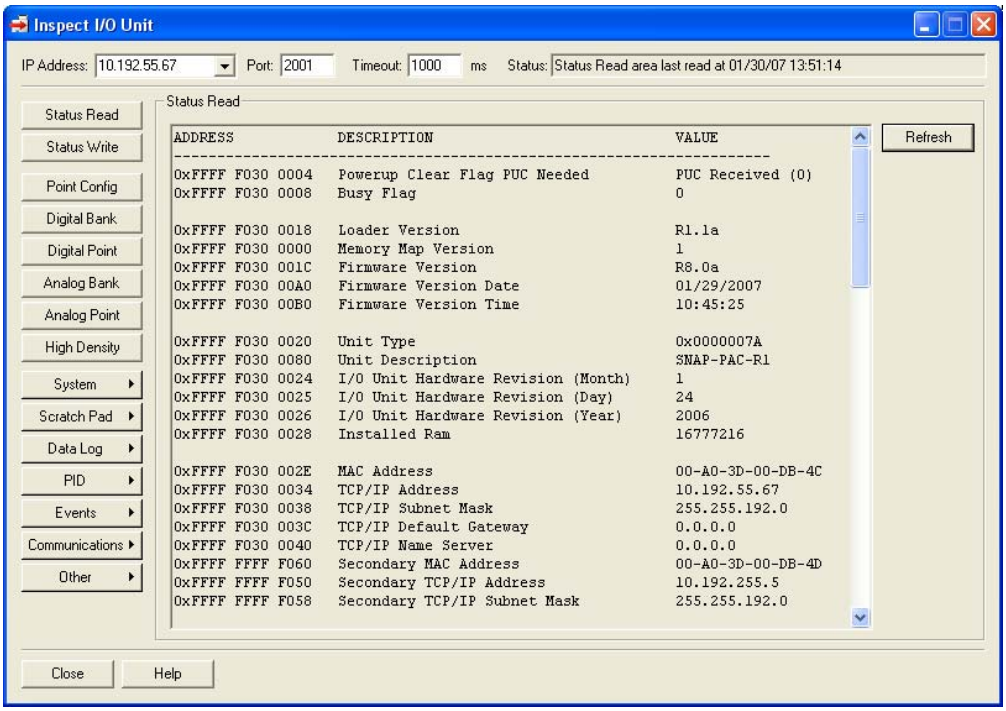
See "Using I/O Point Features" on page 68 for a description of features.

PAC-R
EB
UIO
EIO
SIO

Configuring Analog and Digital Points and Features

NOTE: To configure E1 and E2 I/O units, see Opto 22 form #1576, Technical Note: I/O Configuration for E1 and E2 Brain Boards.

1. In the PAC Manager main window, click the Inspect button .


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Close
Help

If you have used the Inspect button before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list.

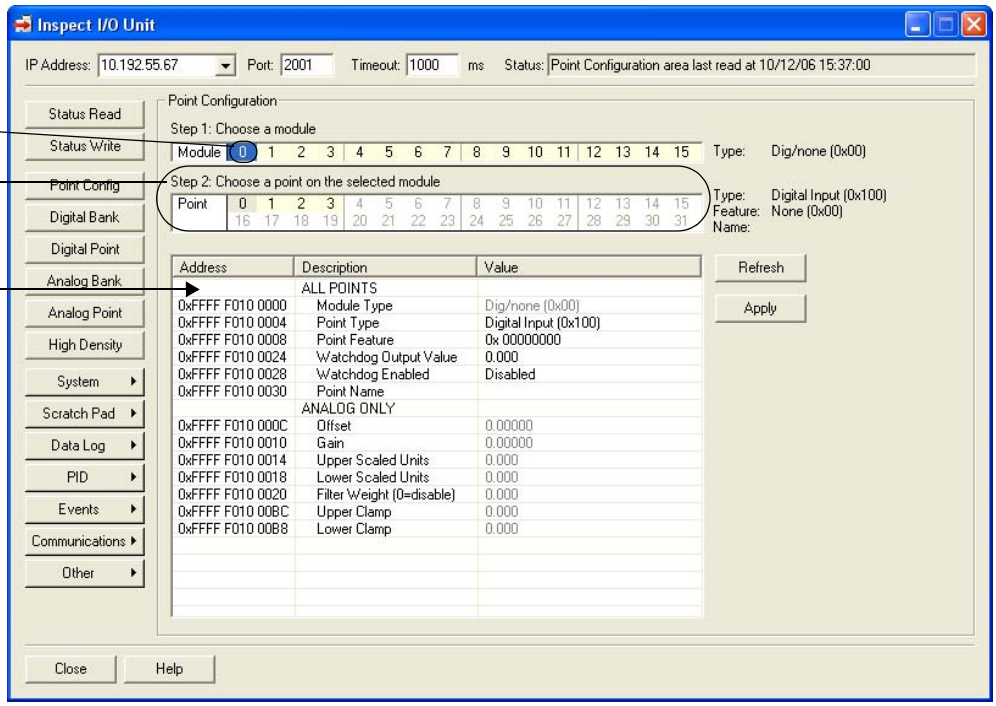
2. In the IP Address field, type the IP address of the I/O unit (or choose it from the drop-down list). Click Point Config.

Module position number

Point numbers for this module are shown in yellow.

Point zero is currently being read here. Since this is not an analog point, analog values are grayed out.

To update values, click the Refresh button. To modify values, change the parameters (if applicable) and click Apply.


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000
ms
Status: Point Configuration area last read at 10/12/06 15:37:00
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Point Configuration
Step 1: Choose a module
Module 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Type: Dig/none (0x00)
Step 2: Choose a point on the selected module
Point 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Type: Digital Input (0x100)
Feature: None (0x00)
Name:
Address
Description
Value
ALL POINTS
0xFFFF F010 0000 Module Type Dig/none (0x00)
0xFFFF F010 0004 Point Type Digital Input (0x100)
0xFFFF F010 0008 Point Feature 0x 00000000
0xFFFF F010 0024 Watchdog Output Value 0.000
0xFFFF F010 0028 Watchdog Enabled Disabled
0xFFFF F010 0030 Point Name
ANALOG ONLY
0xFFFF F010 000C Offset 0.00000
0xFFFF F010 0010 Gain 0.00000
0xFFFF F010 0014 Upper Scaled Units 0.000
0xFFFF F010 0018 Lower Scaled Units 0.000
0xFFFF F010 0020 Filter Weight (0=disable) 0.000
0xFFFF F010 00BC Upper Clamp 0.000
0xFFFF F010 00B8 Lower Clamp 0.000
Refresh
Apply
Close
Help

Module position numbers are shown near the top of the page; point numbers are shown below. For more information on locating modules and points, see "Referencing I/O Points" on page 153.

3. Click the module position and the point number you want to view or configure.
4. Choose or enter the following as necessary for the point.
   a. Choose the point type from the drop-down list.

      For help, see "Point Type Configuration Tables" on page 161 and "Using I/O Point Features" on page 68.

   b. Configure digital input counters in the Point Feature field as shown below:

0x00000000	Disables all digital point features
0x00000001	Enables and starts counter on digital input
0x00000004	Simple quadrature counter input (requires SNAP quadrature input module)
0x00000041	Quadrature counter input with index (requires SNAP quadrature input module)

   c. For automatic reaction to analog or digital watchdogs, enable the watchdog and enter the value that the output point should be set to if the watchdog is tripped.

d. (Analog points only) To set offset and gain for the point manually, enter values in those fields. (To have the processor compute offset and gain, see "Reading and Writing to Analog Points" on page 172.)

e. (Analog points only) Set upper and lower scaled units, filter weight, and upper and lower clamps as necessary. (For help, see "Using I/O Point Features" on page 68.)

5. When all lines are correct, click Apply to send the configuration to the I/O unit.

All other points on the same module are automatically configured with the same features and the same point name.

6. Click another point on the same module and change its point name and features as necessary.

7. Repeat steps for each module you need to configure.

To save configuration to flash memory, see "Saving to an I/O Unit's Flash Memory" on page 185.

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Point Type Configuration Tables

The following tables help you configure points by showing the part number, the point type in decimal and in hex, and the module type in hex (module type is read-only). For analog modules, tables also include the number of points per module, the unit of measurement for the module, and its range.

Digital Input and Output Modules page 161
Analog Input Modules page 162
Analog Output Modules page 165

Digital Input and Output Modules

Module & Description	Point Type (Dec)	Point Type (Hex)	Module Type (Hex)
Digital input module*	256	100	00
Digital output module*	384	180	00

* Does not apply to SNAP high-density digital modules, which are recognized by the processor.

Analog Input Modules

Use this data for configuring point types and features (see page 158). If a module has multiple listings, the default point type is shaded.

Part Number & Description	Point Type (Dec)	Point Type (Hex)	Module Type (Hex)	Points per Module	Default Unit of Measurement	Underrange	Low Scale	Full Scale	Overrange
SNAP-AIARMS: 0 - 10 A AC/DC	71	47	71	2	A	0.0	0.0	10.0	11.0
SNAP-AIARMS-i: 0 - 10 A AC/DC	71	47	28	2	A	0.0	0.0	10.0	11.0
SNAP-AICTD: ICTD Temp. Probe	4	4	04	2	Degrees C	-273.0	-40.0	150.0	150.0
SNAP-AICTD-4: ICTD Temp. Probe	4	4	42	4	Degrees C	-273.0	-40.0	150.0	150.0
SNAP-AILC: -2 - +2 mV/V Fast	34	22	0B	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC: -2 - +2 mV/V Slow	36	24	0B	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC: -3 - +3 mV/V Fast	35	23	0B	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC: -3 - +3 mV/V Slow	37	25	0B	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC: Filter of 1st channel	0	0	0B	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC-2: -3 - +3 mV/V Fast	35	23	0C	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC-2: -3 - +3 mV/V Slow	37	25	0C	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC-2: -4 - +4 mV/V Fast	34	22	0C	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC-2: -4 - +4 mV/V Slow	36	24	0C	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AILC-2: Filter of 1st channel	0	0	0C	2	Percent	-110.0	-100.0	100.0	110.0
SNAP-AIMA: -20 - +20 mA	64	40	64	2	mA	-22.0	-20.0	20.0	22.0
SNAP-AIMA: 0 - +20 mA	2	2	64	2	mA	-22.0	0.0	20.0	22.0
SNAP-AIMA: 4 - +20 mA	3	3	64	2	mA	-22.0	4.0	20.0	22.0
SNAP-AIMA2-i: -1 to +1 mA	85	55	27	2	mA	-1.1	-1.0	1.0	1.1
SNAP-AIMA-i: -20 - +20 mA	64	40	22	2	mA	-22.0	-20.0	20.0	22.0
SNAP-AIMA-i: 0 - +20 mA	2	2	22	2	mA	-22.0	0.0	20.0	22.0
SNAP-AIMA-i: 4 - +20 mA	3	3	22	2	mA	-22.0	4.0	20.0	22.0
SNAP-AIMA-iSRC: -20 - +20 mA	64	40	26	2	mA	-22.0	-20.0	20.0	22.0
SNAP-AIMA-iSRC: 0 - +20 mA	2	2	26	2	mA	-22.0	0.0	20.0	22.0
SNAP-AIMA-iSRC: 4 - +20 mA	3	3	26	2	mA	-22.0	4.0	20.0	22.0
SNAP-AIMA-4: -20 - +20 mA	64	40	40	4	mA	-22.0	-20.0	20.0	22.0
SNAP-AIMA-4: 0 - +20 mA	2	2	40	2	mA	-22.0	0.0	20.0	22.0
SNAP-AIMA-4: 4 - +20 mA	3	3	40	2	mA	-22.0	4.0	20.0	22.0
SNAP-AIMA-32: -20 to +20 mA	64	40	4D	32	mA	-22.0	-20.0	20.0	22.0
SNAP-AIMA-32: 0 - +20 mA	2	2	4D	32	mA	-22.0	0.0	20.0	22.0
SNAP-AIMA-32: 4 - +20 mA	3	3	4D	32	mA	-22.0	4.0	20.0	22.0
SNAP-AIMV-4: -150 - +150 mV	66	42	44	4	mV	-165.0	-150.0	150.0	165.0
SNAP-AIMV-4: -75 - +75 mV	68	44	44	4	mV	-82.5	-75.0	75.0	82.5
SNAP-AIMV2-4: -50 - +50 mV	9	9	45	4	mV	-55.0	-50.0	50.0	55.0

Part Number & Description	Point Type (Dec)	Point Type (Hex)	Module Type (Hex)	Points per Module	Default Unit of Measurement	Underrange	Low Scale	Full Scale	Overrange
SNAP-AIMV2-4: -25 - +25 mV	67	43	45	4	mV	-27.5	-25.0	25.0	27.5
SNAP-AIPM (point 1 only)	70	46	0A	*	AC VRMS	-27.5	0	250	27.5
SNAP-AIPM (point 2 only)	71	47	0A	*	AC ARMS	-27.5	0	10	27.5
SNAP-AIPM (point 3 only)	82	52	0A	*	True power	n/a	n/a	n/a	n/a
SNAP-AIPM (point 4 only)	83	53	0A	*	Volt/Amps	n/a	n/a	n/a	n/a
SNAP-AIRATE: Rate (Frequency)	69	45	69	2	Hz	0.0	0.0	25000.0	27500.0
SNAP-AIRTD: 100 Ohm Pt 3-wire	10	A	10	2	Degrees C	-200.0	-200.0	850.0	850.0
SNAP-AIRTD: 100 Ohm Ni 3-wire	46	2E	10	2	Degrees C	-60.0	-60.0	250.0	250.0
SNAP-AIRTD: 120 Ohm Ni 3-wire	48	30	10	2	Degrees C	-80.0	-80.0	260.0	260.0
SNAP-AITM: -150 - +150 mV	66	42	66	2	mV	-165.0	-150.0	150.0	165.0
SNAP-AITM: -75 - +75 mV	68	44	66	2	mV	-82.5	-75.0	75.0	82.5
SNAP-AITM: Type E Thermocouple	19	13	66	2	Degrees C	-270.0	-270.0	1000.0	1000.0
SNAP-AITM: Type J Thermocouple	5	5	66	2	Degrees C	-210.0	-210.0	1200.0	1200.0
SNAP-AITM: Type K Thermocouple	8	8	66	2	Degrees C	-270.0	-270.0	1372.0	1372.0
SNAP-AITM-i: -150 - +150 mV	66	42	20	2	mV	-165.0	-150.0	150.0	165.0
SNAP-AITM-i: -75 - +75 mV	68	44	20	2	mV	-82.5	-75.0	75.0	82.5
SNAP-AITM-i: Type E Thermocouple	19	13	20	2	Degrees C	-270.0	-270.0	1000.0	1000.0
SNAP-AITM-i: Type J Thermocouple	5	5	20	2	Degrees C	-210.0	-210.0	1200.0	1200.0
SNAP-AITM-i: Type K Thermocouple	8	8	20	2	Degrees C	-270.0	-270.0	1372.0	1372.0
SNAP-AITM-8: -75 - +75 mV	68	44	4F	8	mV	-82.5	-75.0	75.0	82.5
SNAP-AITM-8: -50 - +50 mV	9	9	4F	8	mV	-55.0	-50.0	50.0	55.0
SNAP-AITM-8: -25 - +25 mV	67	43	4F	8	mV	-27.5	-25.0	25.0	27.5
SNAP-AITM-8: Type B Thermocouple	24	18	4F	8	Degrees C	42.0	42.0	1820.0	1820.0
SNAP-AITM-8: Type C Thermocouple	32	20	4F	8	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM-8: Type D Thermocouple	33	21	4F	8	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM-8: Type E Thermocouple	19	13	4F	8	Degrees C	-270.0	-270.0	1000.0	1000.0
SNAP-AITM-8: Type G Thermocouple	31	1F	4F	8	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM-8: Type J Thermocouple	5	5	4F	8	Degrees C	-210.0	-210.0	1200.0	1200.0
SNAP-AITM-8: Type K Thermocouple	8	8	4F	8	Degrees C	-270.0	-270.0	1372.0	1372.0
SNAP-AITM-8: Type N Thermocouple	30	1E	4F	8	Degrees C	-270.0	-270.0	1300.0	1300.0
SNAP-AITM-8: Type R Thermocouple	17	11	4F	8	Degrees C	-50.0	-50.0	1768.0	1768.0
SNAP-AITM-8: Type S Thermocouple	23	17	4F	8	Degrees C	-50.0	-50.0	1768.0	1768.0
SNAP-AITM-8: Type T Thermocouple	18	12	4F	8	Degrees C	-270.0	-270.0	400.0	400.0
SNAP-AITM2: -50 - +50 mV	9	9	09	2	mV	-55.0	-50.0	50.0	55.0
SNAP-AITM2: -25 - +25 mV	67	43	09	2	mV	-27.5	-25.0	25.0	27.5
SNAP-AITM2: Type B Thermocouple	24	18	09	2	Degrees C	42.0	42.0	1820.0	1820.0
SNAP-AITM2: Type C Thermocouple	32	20	09	2	Degrees C	0.0	0.0	2320.0	2320.0

Part Number & Description	Point Type (Dec)	Point Type (Hex)	Module Type (Hex)	Points per Module	Default Unit of Measurement	Underrange	Low Scale	Full Scale	Overrange
SNAP-AITM2: Type D Thermocouple	33	21	09	2	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM2: Type G Thermocouple	31	1F	09	2	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM2: Type N Thermocouple	30	1E	09	2	Degrees C	-270.0	-270.0	1300.0	1300.0
SNAP-AITM2: Type R Thermocouple	17	11	09	2	Degrees C	-50.0	-50.0	1768.0	1768.0
SNAP-AITM2: Type S Thermocouple	23	17	09	2	Degrees C	-50.0	-50.0	1768.0	1768.0
SNAP-AITM2: Type T Thermocouple	18	12	09	2	Degrees C	-270.0	-270.0	400.0	400.0
SNAP-AITM2-i: -50 - +50 mV	9	9	21	2	mV	-55.0	-50.0	50.0	55.0
SNAP-AITM2-i: -25 - +25 mV	67	43	21	2	mV	-27.5	-25.0	25.0	27.5
SNAP-AITM2-i: Type B Thermocouple	24	18	21	2	Degrees C	42.0	42.0	1820.0	1820.0
SNAP-AITM2-i: Type C Thermocouple	32	20	21	2	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM2-i: Type D Thermocouple	33	21	21	2	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM2-i: Type G Thermocouple	31	1F	21	2	Degrees C	0.0	0.0	2320.0	2320.0
SNAP-AITM2-i: Type N Thermocouple	30	1E	21	2	Degrees C	-270.0	-270.0	1300.0	1300.0
SNAP-AITM2-i: Type R Thermocouple	17	11	21	2	Degrees C	-50.0	-50.0	1768.0	1768.0
SNAP-AITM2-i: Type S Thermocouple	23	17	21	2	Degrees C	-50.0	-50.0	1768.0	1768.0
SNAP-AITM2-i: Type T Thermocouple	18	12	21	2	Degrees C	-270.0	-270.0	400.0	400.0
SNAP-AIV: -10 - +10 VDC	12	C	12	2	VDC	-11.0	-10.0	10.0	11.0
SNAP-AIV: -5 - +5 VDC	11	B	12	2	VDC	-5.5	-5.0	5.0	5.5
SNAP-AIV-i: -10 - +10 VDC	12	C	23	2	VDC	-11.0	-10.0	10.0	11.0
SNAP-AIV-i: -5 - +5 VDC	11	B	23	2	VDC	-5.5	-5.0	5.0	5.5
SNAP-AIV-4: -10 - +10 VDC	12	C	41	4	VDC	-11.0	-10.0	10.0	11.0
SNAP-AIV-4: -5 - +5 VDC	11	B	41	4	VDC	-5.5	-5.0	5.0	5.5
SNAP-AIV-32: -10 - +10 VDC	12	C	4E	32	VDC	-11.0	-10.0	10.0	11.0
SNAP-AIV-32: -5 - +5 VDC	11	B	4E	32	VDC	-5.5	-5.0	5.0	5.5
SNAP-AIV2-i: -100 - +100 VDC	72	48	24	2	VDC	-110.0	-100.0	100.0	110.0
SNAP-AIV2-i: -50 - +50 VDC	73	49	24	2	VDC	-55.0	-50.0	50.0	55.0
SNAP-AIVRMS: 0 - 250 VAC/VDC	70	46	70	2	VAC/VDC	0.0	0.0	250.0	275.0
SNAP-AIVRMS-i: 0 - 250 VAC/VDC	70	46	29	2	VAC/VDC	0.0	0.0	250.0	275.0
SNAP-AIR40K-4: 0 to 40K Ohms	74	4A	43	4	Ohms	0	0	40000.0	44000.0
SNAP-AIR40K-4: 0 to 20K Ohms	75	4B	43	4	Ohms	0	0	20000.0	22000.0
SNAP-AIR40K-4: 0 to 10K Ohms	76	4C	43	4	Ohms	0	0	10000.0	11000.0
SNAP-AIR40K-4: 0 to 5K Ohms	77	4D	43	4	Ohms	0	0	5000.0	5500.0
SNAP-pH/ORP: -1 - +1 VDC	78	4E	25	2	VDC	-1.1	-1.0	1.0	1.1
SNAP-pH/ORP: 0 - 14 pH	79	4F	25	2	pH	-1.4	0.0	14.0	15.4
SNAP-pH/ORP: -0.5 - +0.5 VDC	80	50	25	2	VDC	-0.55	-0.5	0.5	0.55
SNAP-PID-V	99	63	D0	4	Percent	0	0	100.0	110.0

* The SNAP-AIPM module monitors one device from point 1 (volts) and point 2 (amps). Points 3 and 4 return calculated values.

Analog Output Modules

Use this data for configuring point types and features (see page 158).

Part Number & Description	Point Type (Dec)	Point Type (Hex)	Module Type (Hex)	Points per Module	Default Unit of Measurement	Underrange	Low scale	Full scale	Overrange
SNAP-AOA-3: 4 - 20 mA	131	83	83	1	mA	4.0	4.0	20.0	20.0
SNAP-AOV-5: 0 - 10 VDC	133	85	85	1	VDC	0.0	0.0	10.0	10.0
SNAP-AOA-23: 4 - 20 mA	163	A3	A3	2	mA	4.0	4.0	20.0	20.0
SNAP-AOA-23-iSRC: 4 - 20 mA	163	A3	B3	2	mA	4.0	4.0	20.0	20.0
SNAP-AOV-25: 0 - 10 VDC	165	A5	A5	2	VDC	0.0	0.0	10.0	10.0
SNAP-AOV-27: -10 - +10 VDC	167	A7	A7	2	VDC	-10.0	-10.0	10.0	10.0
SNAP-AOA-28: 0 - 20 mA	168	A8	A8	2	mA	0.0	0.0	20.0	20.0
SNAP-AOD-29: TPO	169	A9	A9	2	percent	n/a	0.0	00.0	n/a

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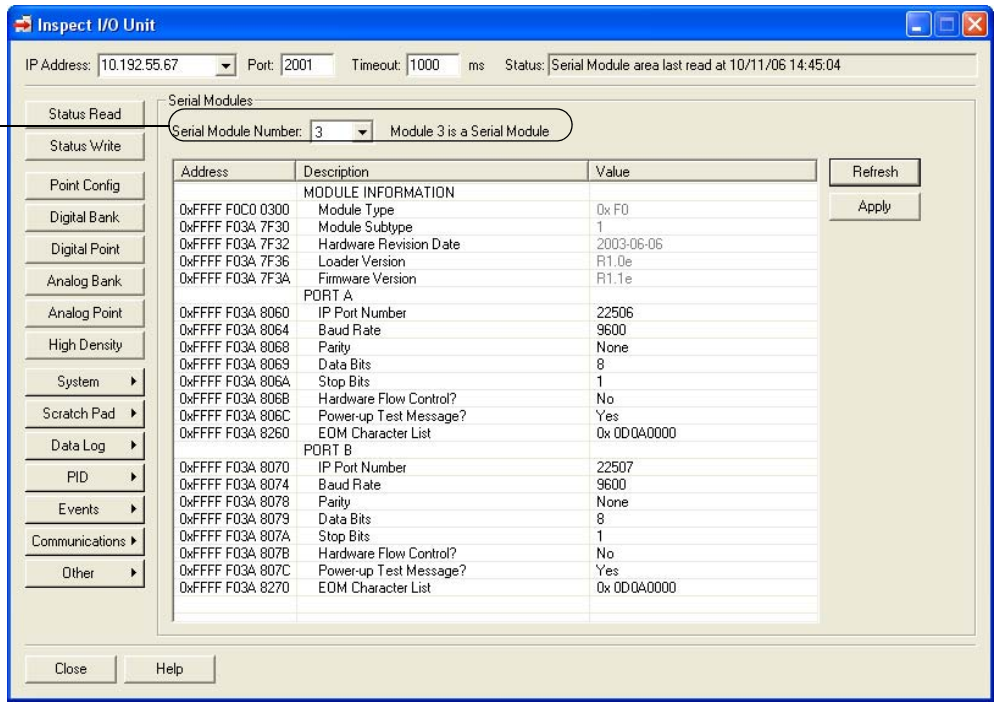
Configuring Serial, Profibus, and Wiegand Modules

Remember that configuration changes made in the Inspect window cannot be saved to a configuration file. To use a configuration file, see Chapter 2.

1. In the PAC Manager main window, click the Inspect button .
2. In the Inspect I/O Unit dialog box, type the IP address of the I/O unit (or choose it from the drop-down list). Click Communications and then click the type of module from the submenu: Serial Modules, Profibus Modules, or Wiegand Modules.
3. Choose the module's position number from the drop-down list.

Data for this module is shown in the window.



For help in understanding or changing data, see Opto 22 form #1191, the *SNAP Serial Communication Module User's Guide*. Also see "Configuring Serial Communication Modules" on page 48, "Configuring Profibus Modules" on page 53, and "Configuring Wiegand Modules" on page 55.

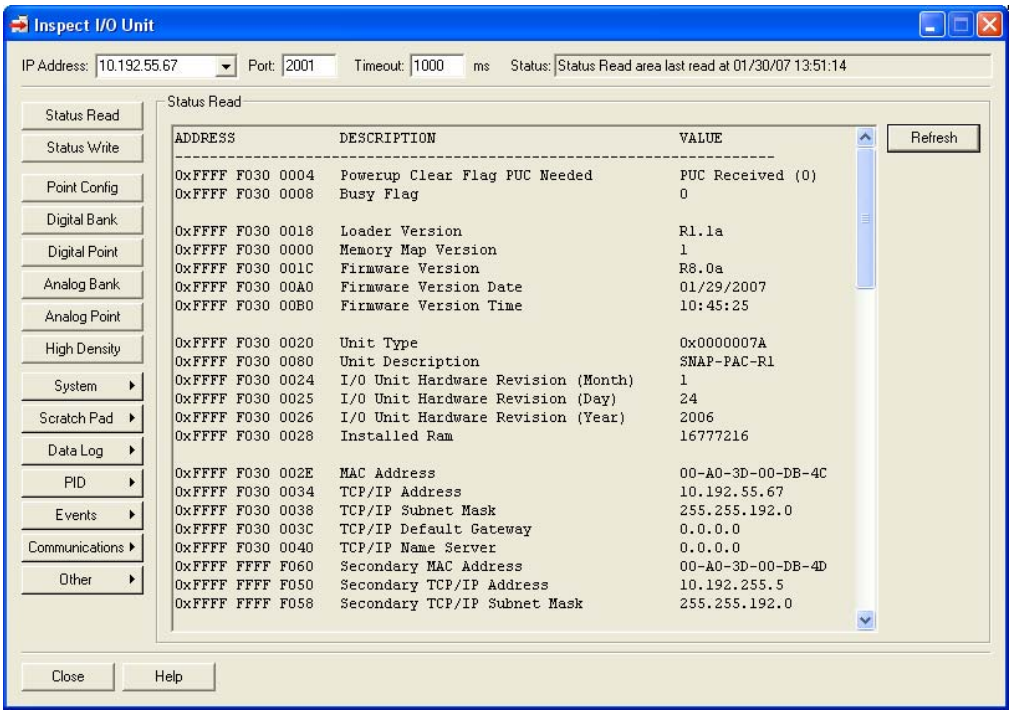
To save configuration to flash memory, see "Saving to an I/O Unit's Flash Memory" on page 185.

PAC-R
EB
UIO
EIO

Configuring, Viewing, or Changing PID Loops

For information about PID loops, see "Configuring PID Loops" on page 61. PIDs are normally configured in a configuration file following the steps on page 61. However, you can also configure, view, or change them using PAC Manager's Inspect window. (Remember that changes made here cannot be saved to a configuration file.)

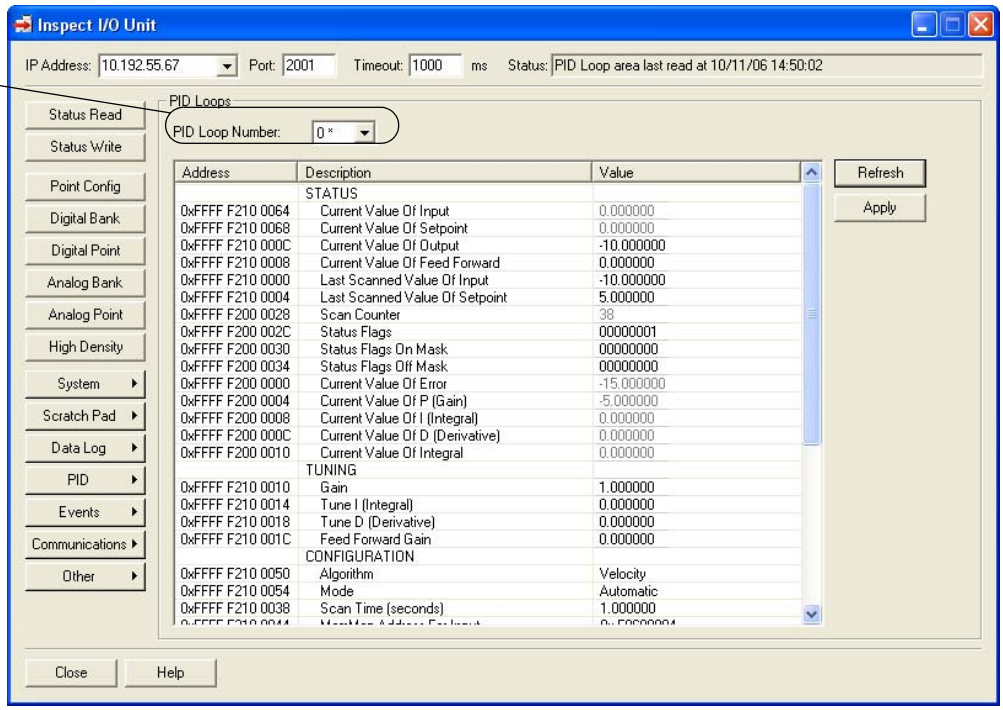
1. In the PAC Manager main window, click the Inspect button .


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Close
Help

If you have used the Inspect button before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the I/O unit (or choose it from the drop-down list). Click PID and choose PID Loops from the submenu.

Information for this PID loop is shown in the window.


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000
ms
Status: PID Loop area last read at 10/11/06 14:50:02
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
PID Loops
PID Loop Number: 0 *
Address
Description
Value
Refresh
Apply
STATUS
0xFFFF F210 0064 Current Value Of Input 0.000000
0xFFFF F210 0068 Current Value Of Setpoint 0.000000
0xFFFF F210 000C Current Value Of Output -10.000000
0xFFFF F210 0008 Current Value Of Feed Forward 0.000000
0xFFFF F210 0000 Last Scanned Value Of Input -10.000000
0xFFFF F210 0004 Last Scanned Value Of Setpoint 5.000000
0xFFFF F200 0028 Scan Counter 38
0xFFFF F200 002C Status Flags 00000001
0xFFFF F200 0030 Status Flags On Mask 00000000
0xFFFF F200 0034 Status Flags Off Mask 00000000
0xFFFF F200 0000 Current Value Of Error -15.000000
0xFFFF F200 0004 Current Value Of P (Gain) -5.000000
0xFFFF F200 0008 Current Value Of I (Integral) 0.000000
0xFFFF F200 000C Current Value Of D (Derivative) 0.000000
0xFFFF F200 0010 Current Value Of Integral 0.000000
TUNING
0xFFFF F210 0010 Gain 1.000000
0xFFFF F210 0014 Tune I (Integral) 0.000000
0xFFFF F210 0018 Tune D (Derivative) 0.000000
0xFFFF F210 001C Feed Forward Gain 0.000000
CONFIGURATION
0xFFFF F210 0050 Algorithm Velocity
0xFFFF F210 0054 Mode Automatic
0xFFFF F210 0038 Scan Time (seconds) 1.000000
Close
Help

3. From the drop-down list, choose the PID loop number you want to configure, view, or change.

   Existing PID loops are indicated by an asterisk (*) next to the number.

4. To configure or change the PID, click inside the cell in the Value column and type the new value or choose it from a drop-down list, if one is available. When you have finished making changes, click Apply to send them to the I/O unit.

NOTE: If you are using PAC Control, it is easiest to tune PID loops in your PAC Control strategy running in Debug mode. See the PAC Control User's Guide for more information.

For information on memory map addresses and what they contain, see the OptoMMP Protocol Guide (form #1465).

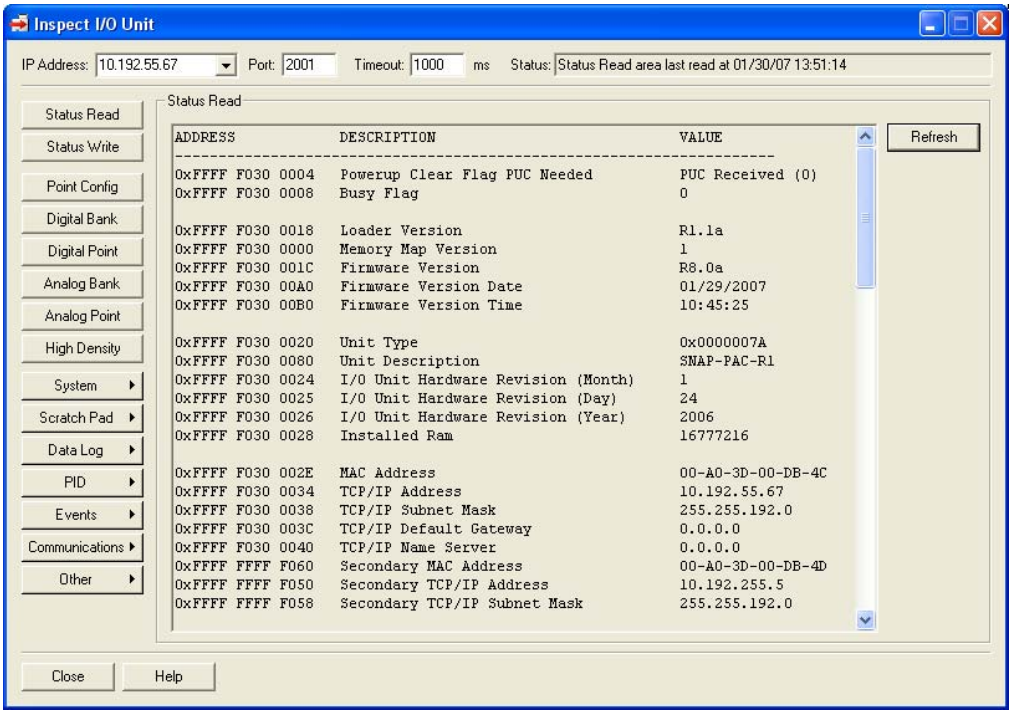
Reading and Writing to Points

PAC-R
EB
UIO
EIO
SIO
E1
E2

You can use PAC Manager to read or change I/O point values. **You must configure points before you can read or write to them.**

CAUTION: *If you are using PAC Control, reading and writing is normally done in the PAC Control strategy logic or in Debug mode. If you use the steps in this section to write to an I/O unit, be very careful you do not interfere with strategy logic.*

1. In the PAC Manager main window, click the Inspect button .


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Close
Help

   If you have used the Inspect button before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the I/O unit (or choose it from the drop-down list).
3. Click Digital Point or Analog Point, depending on the type of point you want to read or write to. Continue with the next section for digital points, or see page 172 for analog points.

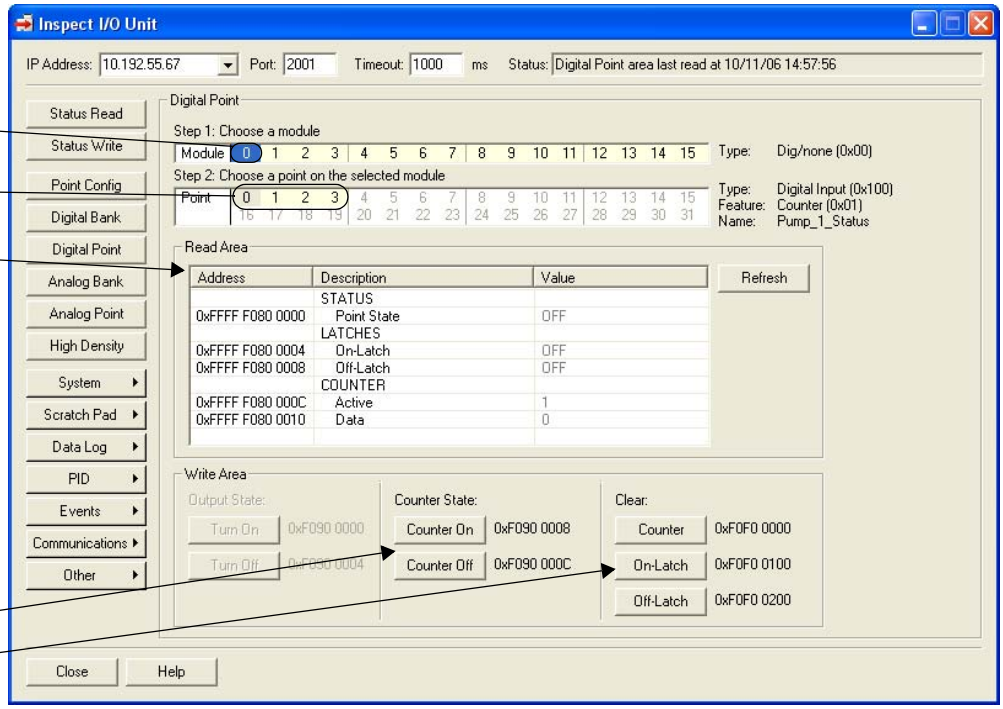
PAC-R
EB
UIO
EIO
SIO
E1

Reading and Writing to Digital Points

NOTE: For points on high-density digital modules, you can read or write to individual points using the steps in this section. To read or write to all points at one time, see "Reading and Writing to SNAP High-Density Digital Points" on page 177.

Digital Input Points

Here's an example showing a digital input point. Module position numbers are shown near the top of the page, with the point numbers for each module listed just below the position number. For more information on locating modules and points, see "Referencing I/O Points" on page 153.



1. Click the point number you want to read or write to.

   The current values for that point number appear in the Read Area. The Status data at the top right corner of the window shows the date and time values were last read. The Read Area and the Write Area change depending upon the point type.

2. To turn counting on or off or to clear counters and latches, click the buttons in the Counter State and Clear areas near the bottom of the window. (For more information on these features, see page 71.)

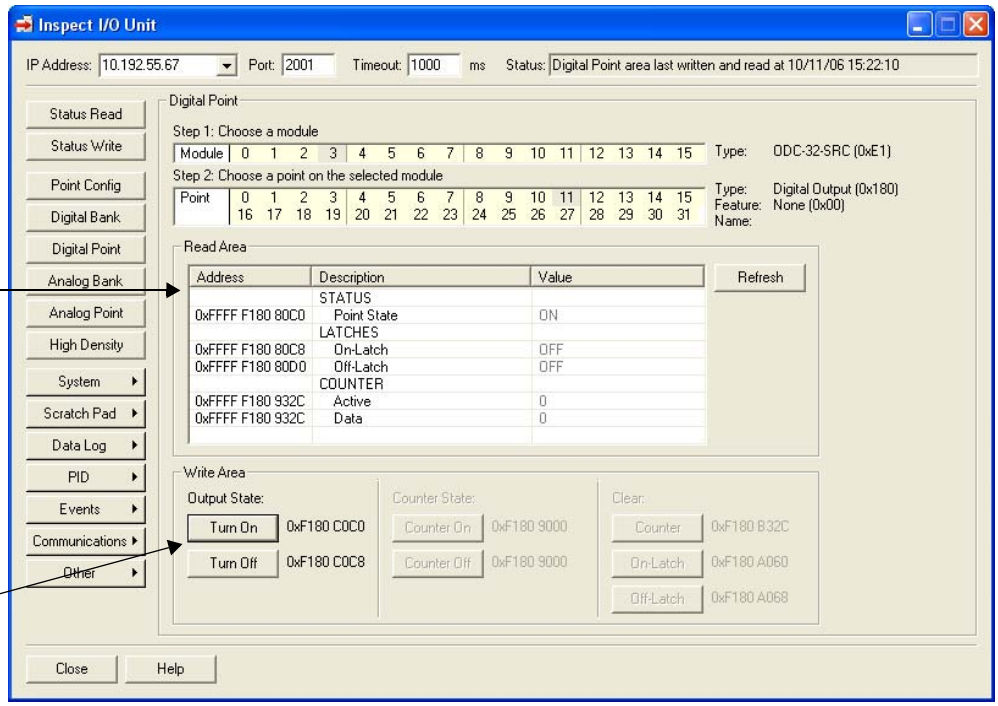
   Your changes are immediately sent to the I/O unit, and the window is updated to reflect your changes.

Digital Output Points

The following example shows a digital output point.

Current values for point 11 on this high-density module.
Click the Refresh button to update values.

Change point state on an output point by clicking a button in the Write Area.



1. Click the point number you want to read or write to.

   The current values for that point number appear in the Read Area. The Status data at the top right corner of the window shows the date and time values were last read. The Read Area and the Write Area change depending upon the point type.

2. To turn an output point on or off, click a button in the Write Area.

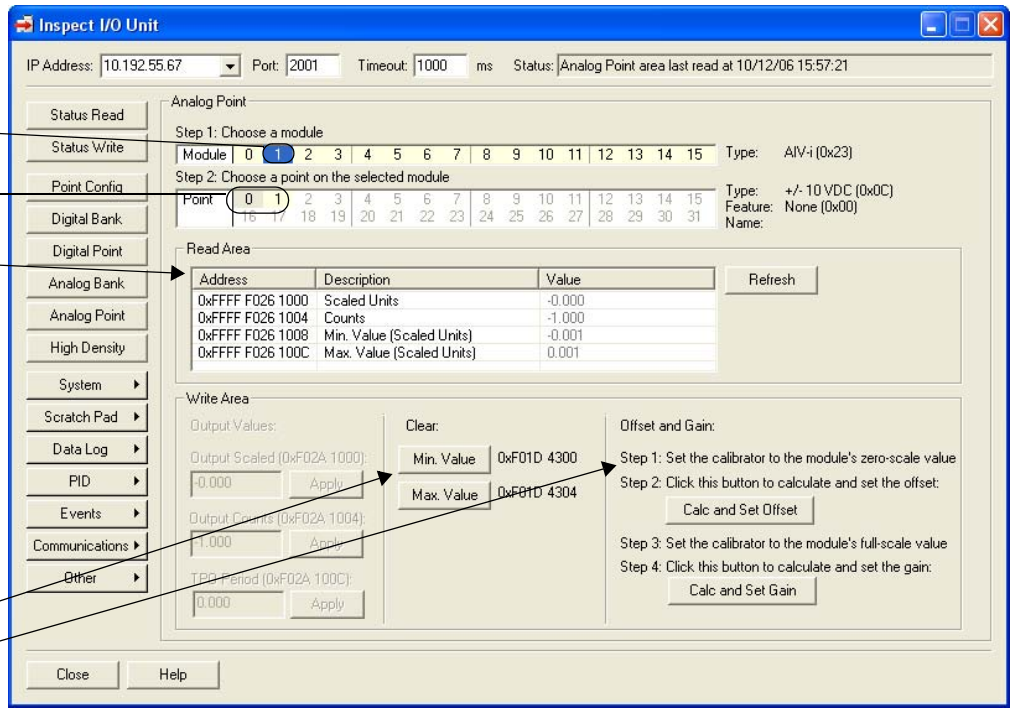
   The change is immediately sent to the I/O unit, and the window is updated.

PAC-R
EB
UIO
EIO
SIO
E2

Reading and Writing to Analog Points

Analog Input Points

This example shows an analog input point. Module position numbers are shown near the top of the page, with the point numbers for each module listed just below the position number. For more on locating modules and points, see "Referencing I/O Points" on page 153.


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Analog Point area last read at 10/12/06 15:57:21
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Analog Point
Step 1: Choose a module
Module 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Type: AIV-i (0x23)
Step 2: Choose a point on the selected module
Point 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Type: +/- 10 VDC (0x0C)
Feature: None (0x00)
Name:
Read Area
Address
Description
Value
0xFFFF F026 1000 Scaled Units -0.000
0xFFFF F026 1004 Counts -1.000
0xFFFF F026 1008 Min. Value (Scaled Units) -0.001
0xFFFF F026 100C Max. Value (Scaled Units) 0.001
Refresh
Write Area
Output Values:
Output Scaled (0xF02A 1000):
-0.000
Apply
Output Counts (0xF02A 1004):
-1.000
Apply
TPO Period (0xF02A 100C):
0.000
Apply
Clear:
Min. Value 0xF01D 4300
Max. Value 0xF01D 4304
Offset and Gain:
Step 1: Set the calibrator to the module's zero-scale value
Step 2: Click this button to calculate and set the offset:
Calc and Set Offset
Step 3: Set the calibrator to the module's full-scale value
Step 4: Click this button to calculate and set the gain:
Calc and Set Gain
Close
Help

Module position number

Point numbers for this module. Point 0 is currently being read here.

Click the Refresh button to update values.

Since point 0 is an input point, you can clear minimum and maximum values or set offset and gain.

1. Click the point number you want to read or write to.

   The current values for that point number appear in the Read Area.

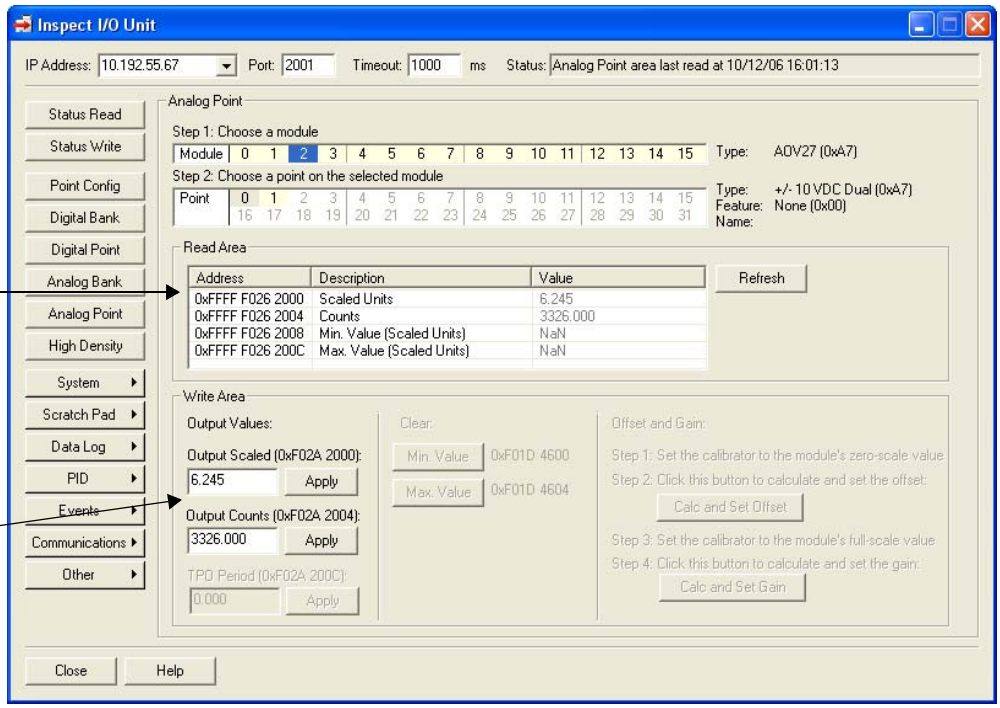
2. To clear minimum and maximum values, click the buttons in the Clear area (see page 73 for information).

3. To set offset and gain, follow the steps in the Offset and Gain area (see page 73.)

   Your changes are immediately sent to the I/O unit, and the window is updated to reflect your changes.

Analog Output Points

The following example shows an analog output point.



Current values for point 0 on module 2. To update values, click the Refresh button.

Change the value on an output point by using the Write Area.

1. Click the point number you want to read or write to.

   The current values for that point number appear in the Read Area.

2. To change the value of an output point, enter the value in the Write Area (either Scaled or Counts) and click Apply.

   The change is immediately sent to the I/O unit, and the window is updated.

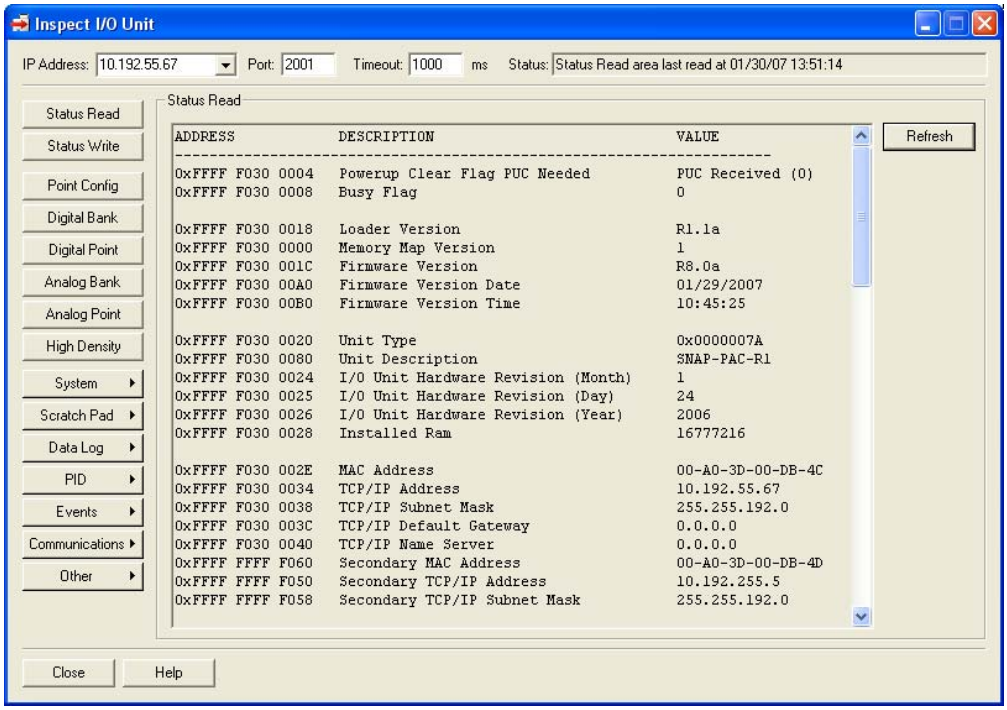
PAC-R
EB
UIO
EIO
SIO
E1
E2

Reading Analog and Digital Banks

You can use PAC Manager to read a bank of points at one time. (Currently it is not possible to write to a bank of points using PAC Manager.) **You must configure points before you can read them.**

NOTE: Bank reading cannot be done on digital or analog modules containing more than four points. To read or write to all points on a high-density digital module, see page 177.

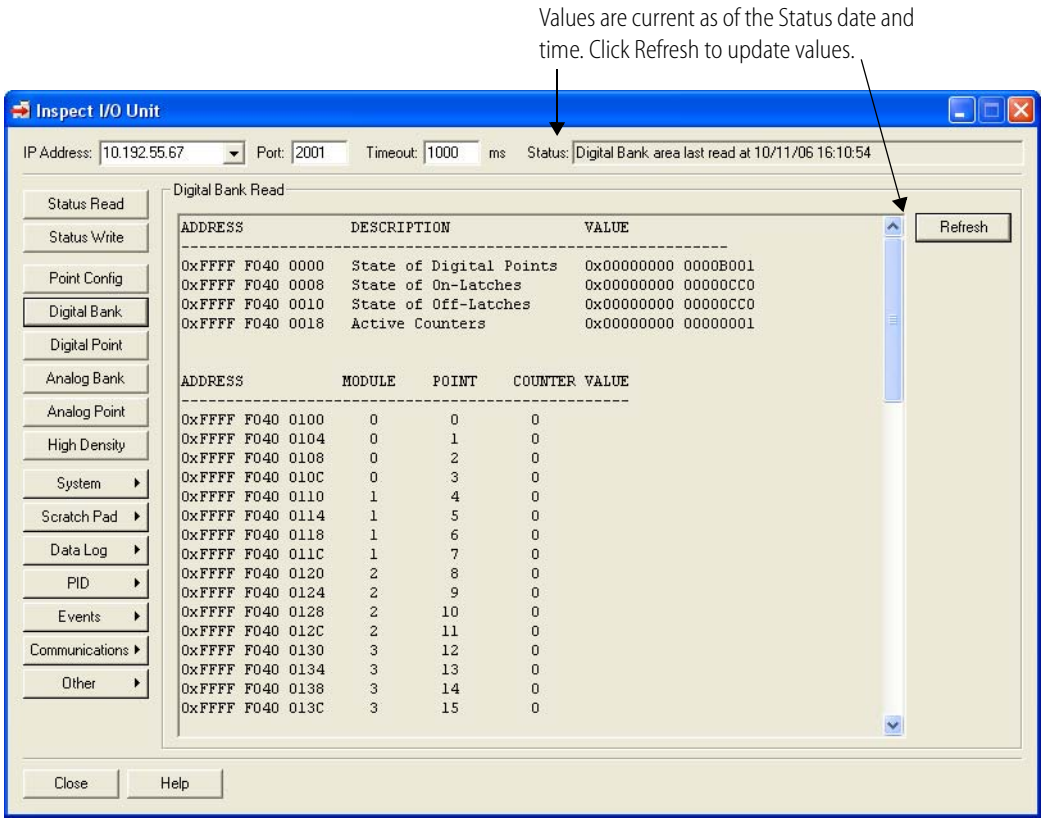
1. In the PAC Manager main window, click the Inspect button .


Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 01/30/07 13:51:14
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.1a
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/29/2007
0xFFFF F030 00B0 Firmware Version Time 10:45:25
0xFFFF F030 0020 Unit Type 0x0000007A
0xFFFF F030 0080 Unit Description SNAP-PAC-R1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 1
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 24
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2006
0xFFFF F030 0028 Installed Ram 16777216
0xFFFF F030 002E MAC Address 00-A0-3D-00-DB-4C
0xFFFF F030 0034 TCP/IP Address 10.192.55.67
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-DB-4D
0xFFFF FFFF F050 Secondary TCP/IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 255.255.192.0
Refresh
Close
Help

If you have used the Inspect button before, the last IP address you used is shown and current Status Read information appears in the window. The most recently used IP addresses are available in the drop-down list.

2. In the IP Address field, type the IP address of the I/O unit (or choose it from the drop-down list). Click Digital Bank or Analog Bank.

Digital Bank Window


Values are current as of the Status date and time. Click Refresh to update values.
Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000 ms
Status: Digital Bank area last read at 10/11/06 16:10:54
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Digital Bank Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F040 0000 State of Digital Points 0x00000000 0000B001
0xFFFF F040 0008 State of On-Latches 0x00000000 00000CC0
0xFFFF F040 0010 State of Off-Latches 0x00000000 00000CC0
0xFFFF F040 0018 Active Counters 0x00000000 00000001
ADDRESS MODULE POINT COUNTER VALUE
0xFFFF F040 0100 0 0 0
0xFFFF F040 0104 0 1 0
0xFFFF F040 0108 0 2 0
0xFFFF F040 010C 0 3 0
0xFFFF F040 0110 1 4 0
0xFFFF F040 0114 1 5 0
0xFFFF F040 0118 1 6 0
0xFFFF F040 011C 1 7 0
0xFFFF F040 0120 2 8 0
0xFFFF F040 0124 2 9 0
0xFFFF F040 0128 2 10 0
0xFFFF F040 012C 2 11 0
0xFFFF F040 0130 3 12 0
0xFFFF F040 0134 3 13 0
0xFFFF F040 0138 3 14 0
0xFFFF F040 013C 3 15 0
Close
Help

Remember that values for points on high-density digital modules are not included.

You can copy part or all of the data in this window and paste it into another file, such as a text file or email. Just highlight what you want to copy, right-click it, and choose Copy from the pop-up menu (or use CTRL-C). To highlight all data in the window, right click in the window and choose Select All.

Data Formats. Most digital bank data is in the form of a mask. For example, the State of Digital Points value shown in the previous figure is this mask:

```
0x00000000 0000B001
```

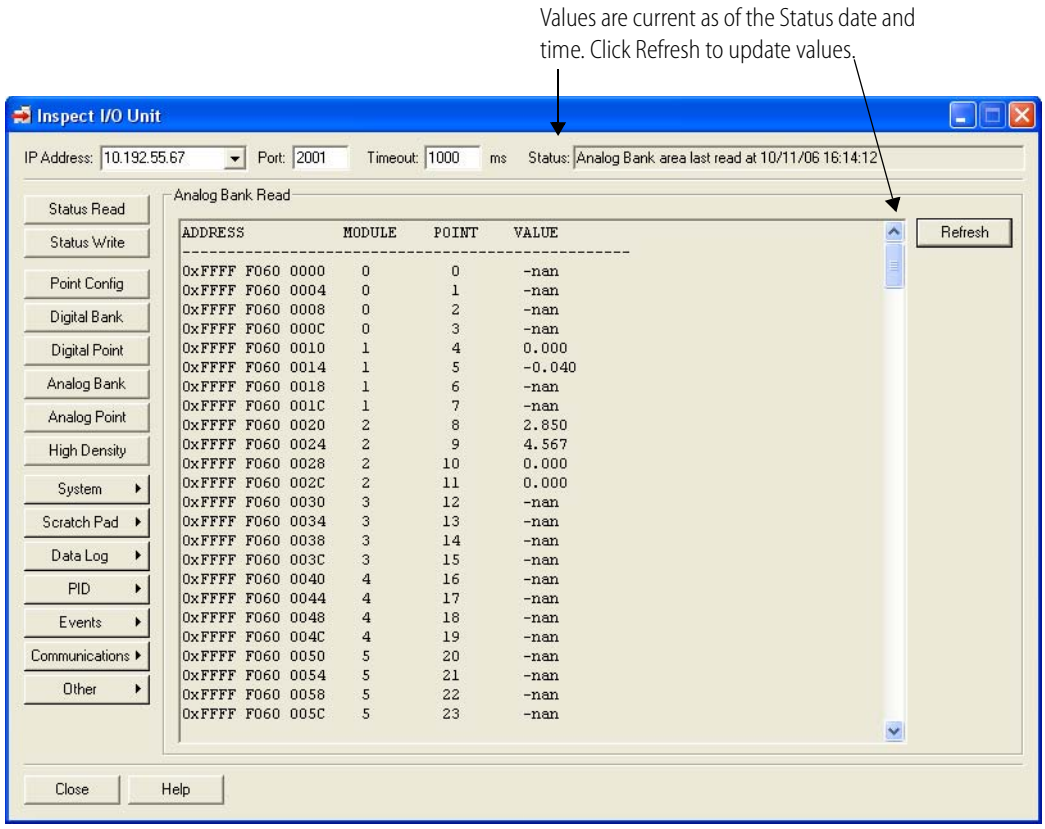
This mask shows, in hex, the state of all 64 possible points (maximum rack of 16 modules with four points per module). The lowest points are on the right:

Hex:	0	0	0	0	0	0	0	0	0	0	0	0	B	0	0	1
Binary:	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	1011	0000	0000	0001
Points:	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0	3-0
Modules:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

In this case, all points are OFF except for point 0 on the module in position 0, and points 0, 1, and 3 on the module in position 3, which are ON. For more help in interpreting bank data, see page 191.

Bank *counter* data, however, uses unsigned 32-bit integers; for help in interpreting counter data, see page 191.

Analog Bank Window


Values are current as of the Status date and time. Click Refresh to update values.
Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000
ms
Status: Analog Bank area last read at 10/11/06 16:14:12
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Analog Bank Read
Refresh
ADDRESS MODULE POINT VALUE
0xFFFF F060 0000 0 0 -nan
0xFFFF F060 0004 0 1 -nan
0xFFFF F060 0008 0 2 -nan
0xFFFF F060 000C 0 3 -nan
0xFFFF F060 0010 1 4 0.000
0xFFFF F060 0014 1 5 -0.040
0xFFFF F060 0018 1 6 -nan
0xFFFF F060 001C 1 7 -nan
0xFFFF F060 0020 2 8 2.850
0xFFFF F060 0024 2 9 4.567
0xFFFF F060 0028 2 10 0.000
0xFFFF F060 002C 2 11 0.000
0xFFFF F060 0030 3 12 -nan
0xFFFF F060 0034 3 13 -nan
0xFFFF F060 0038 3 14 -nan
0xFFFF F060 003C 3 15 -nan
0xFFFF F060 0040 4 16 -nan
0xFFFF F060 0044 4 17 -nan
0xFFFF F060 0048 4 18 -nan
0xFFFF F060 004C 4 19 -nan
0xFFFF F060 0050 5 20 -nan
0xFFFF F060 0054 5 21 -nan
0xFFFF F060 0058 5 22 -nan
0xFFFF F060 005C 5 23 -nan
Close
Help

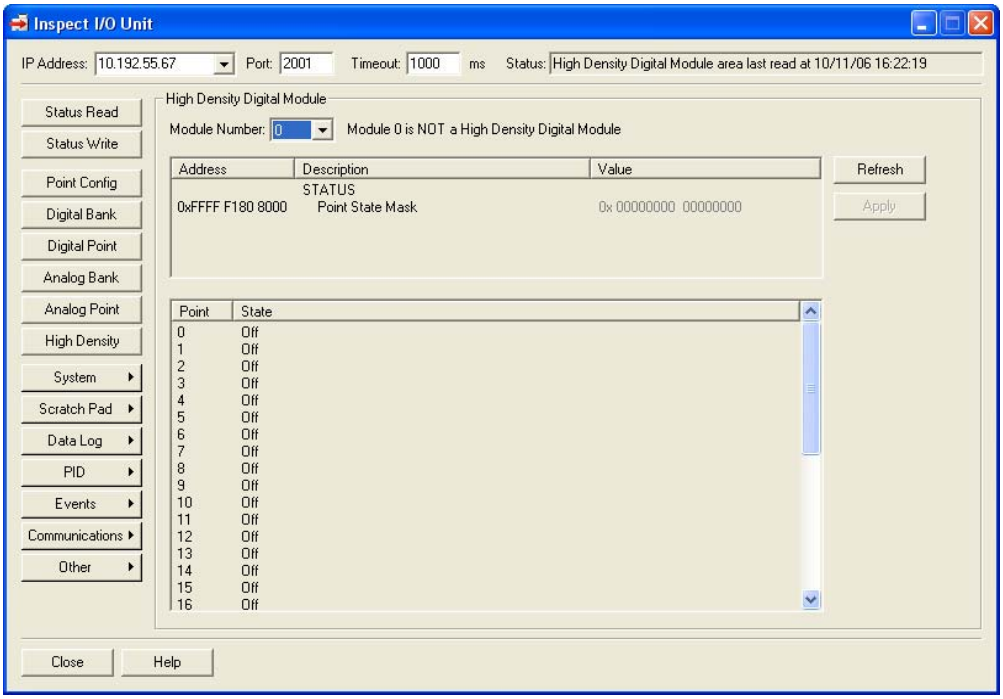
For help in interpreting analog point data, see "IEEE Float Data" on page 192.

PAC-R
EB
UIO
EIO
SIO

Reading and Writing to SNAP High-Density Digital Points

In PAC Manager, you can read or write to points on high-density digital modules in two ways: one at a time using the Digital Point button (see page 170), or all at once as shown below.

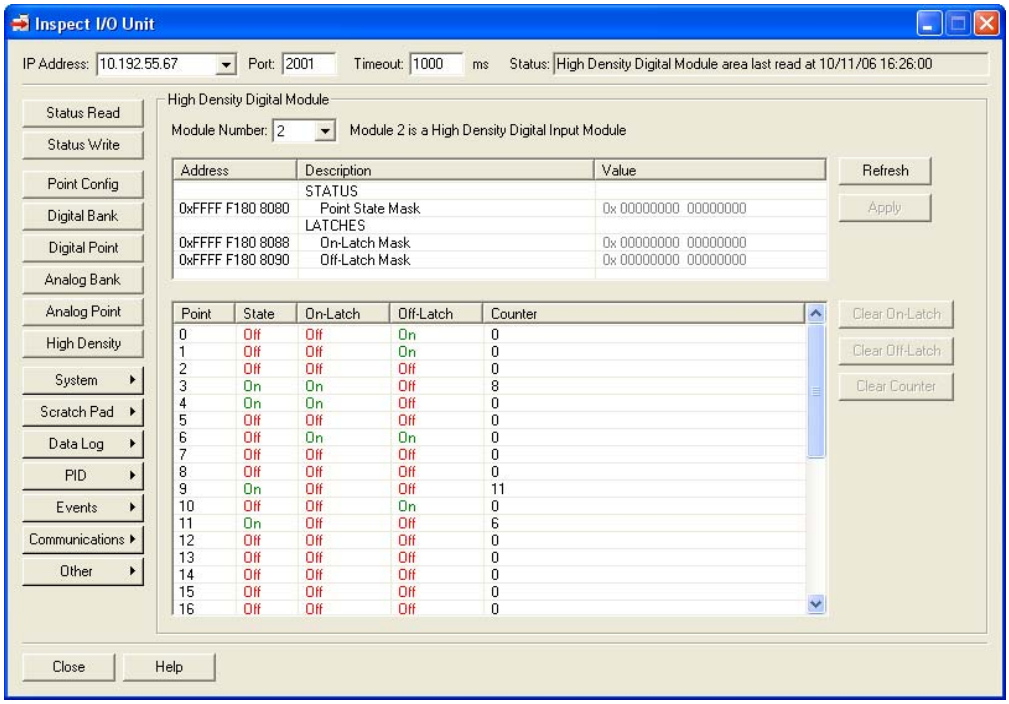
1. To read or write to points on high-density digital modules, click the Inspect button in the PAC Manager main window.
2. In the Inspect I/O Unit window, type the IP address of the I/O unit (or choose it from the drop-down list). Click High Density.



3. Click the module number for the point you want to read or write to.

SNAP High-Density Digital Input

For an input module, the current states and latches appear, both as bitmasks in hex and individually for each point. Counter values appear in the Counter column.

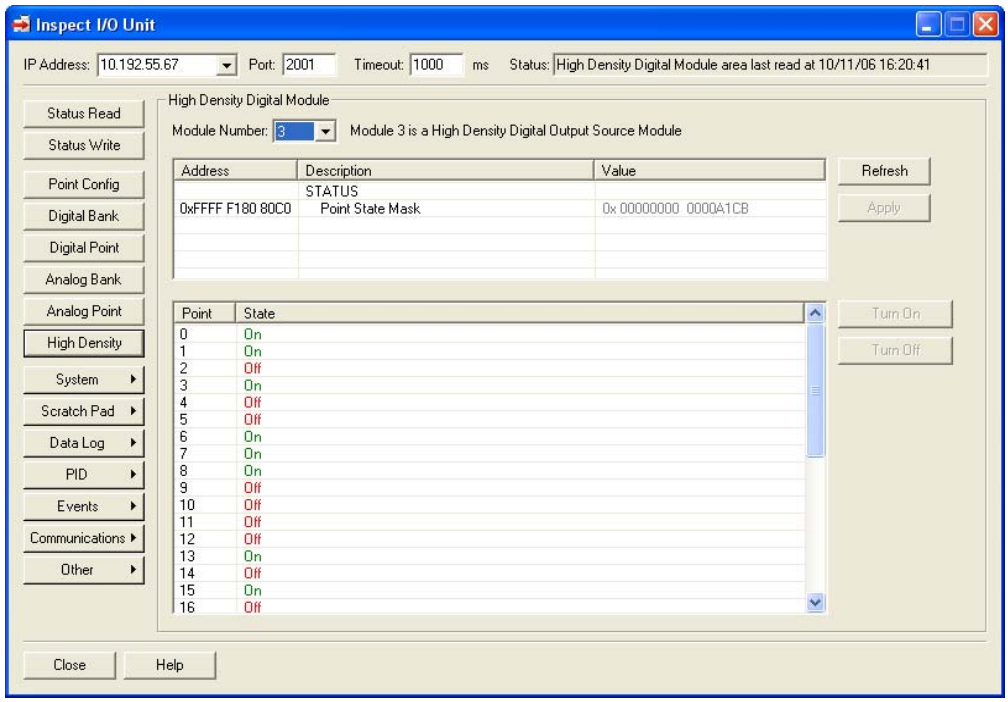


To clear latches for a point, highlight the point number and click the Clear On-Latch or Clear Off-Latch button. To clear the counter for a point, highlight the point and click the Clear Counter button.

The change is immediately sent to the I/O unit, and the window is updated.

SNAP High-Density Digital Output

For an output module, the current states appear, as bitmasks in hex and for each point:



To turn a point on or off, highlight the point number and click the Turn On or Turn Off button. The change is immediately sent to the I/O unit, and the window is updated.

PAC-S
PAC-R
EB
UIO
EIO

Reading System Date and Time

SNAP PAC controllers and SNAP Ultimate and SNAP-ENET-RTC brains have a realtime clock.

1. To read the date and time on the device, click the Inspect button in the PAC Manager main window.
2. In the Inspect window, type the IP address of the device (or choose it from the drop-down list). Click System→Date And Time.

   The device's date and time appear.

NOTE: Although you can change the date and time by clicking a cell in the Value column and typing in the new number, then clicking Apply, there is a slight delay before the time is set on the unit. Other ways of setting time may be more accurate, for example, using PAC Control to synchronize system date and time. Also see "Setting Up System Date and Time" on page 111 for another method.

PAC-S
PAC-R
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EIO

Reading and Writing to the Scratch Pad Area

Before using this section, be sure to read "Event/Reaction Concepts" on page 124. Remember that support for these areas varies by processor:

	PAC-R	PAC-S	EB1	EB2	UIO	EIO	SIO
Scratch Pad Bits:	Yes	Yes	Yes	Yes	Yes	Yes	No
Scratch Pad Integers, Strings, Floats:	Yes	Yes	Yes	Yes	Yes	No	No

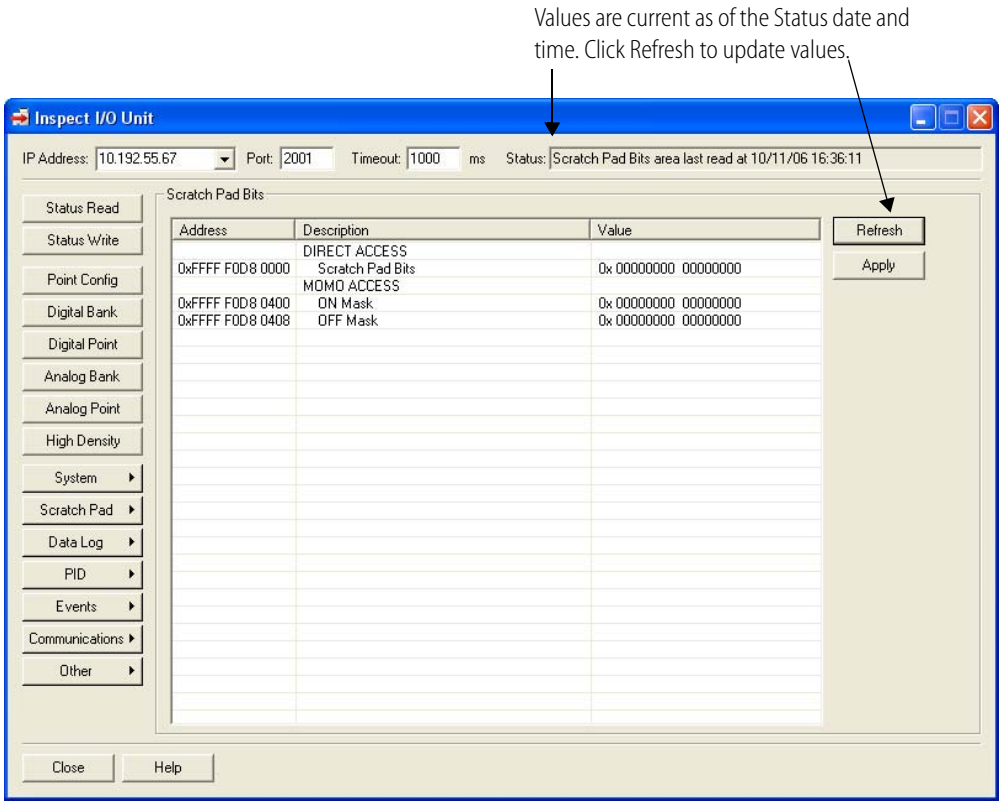
You can read the current state of Scratch Pad bits and current values in Scratch Pad integers, strings, and floats using PAC Manager. You can also change these values in real time, which can be useful for testing. **If you are running PAC Control, make sure your changes do not conflict with strategy logic.**

1. To read or change the Scratch Pad area, click the Inspect button in the PAC Manager main window.
2. In the Inspect I/O Unit dialog box, type the IP address of the I/O unit (or choose it from the drop-down list). Click Scratch Pad and then choose the area you want from the pop-up menu.

PAC-S
PAC-R
EB
UIO
EIO

Scratch Pad Bits

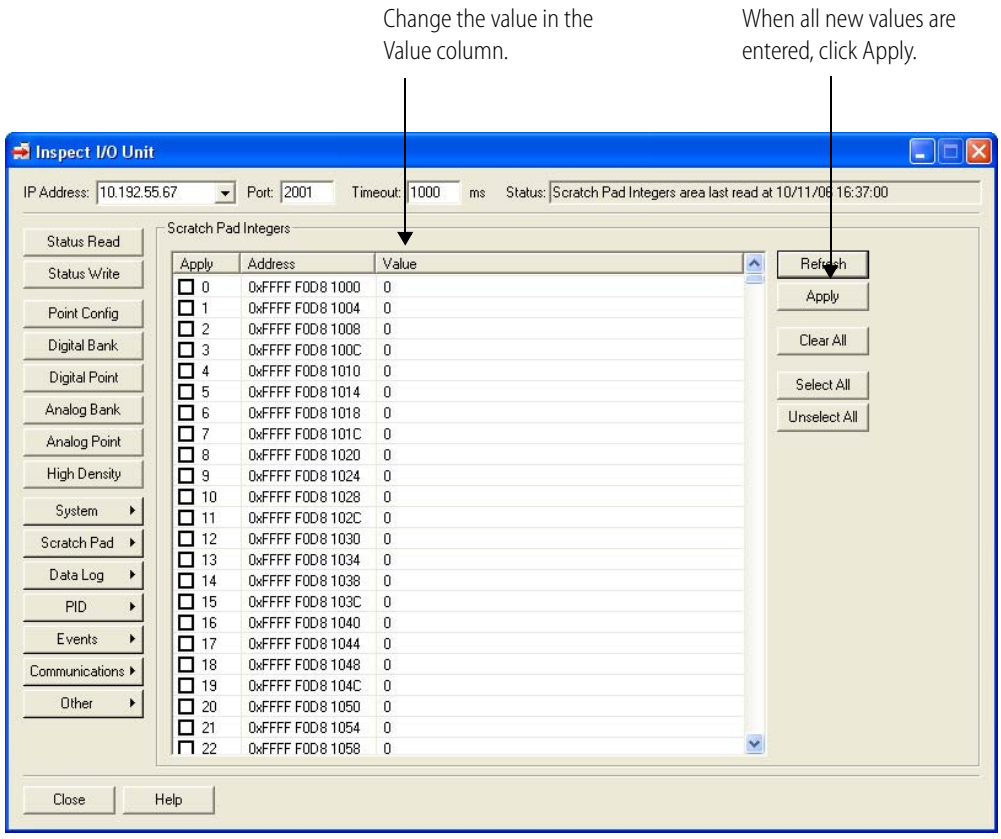
The Scratch Pad bits window shows you the current state of the Scratch Pad bits (as of the Status date and time) and the current On and Off masks. You can change any of these masks by clicking its cell in the Value column and typing in the new mask, then clicking Apply.



PAC-S
PAC-R
EB
UIO

Scratch Pad Integers, Floats, and Strings

Scratch Pad Integers is used as the example here, but floats and strings are similar. Current values are shown as of the Status date and time. To update values, click Refresh.



The Select All and Unselect All buttons control the check marks in the Apply column boxes. The Clear All button puts all values at zero.

1. To change a value in Scratch Pad integers, floats, or strings, click the cell in the Value column and type the new value.

   A checkmark appears in the Apply column box. If you do not want to send a value, click the box to uncheck it.

2. Click the Apply button to write the new values to the Scratch Pad.

   All the checked items are changed.

PAC-R EB UIO EIO

Data Logging

Data logging is normally configured in a configuration file (see page 82), but you can change it in the Inspect window. Remember that changes made here cannot be saved to a configuration file, however. To change configuration, with the I/O unit's IP address in the Inspect window, click Data Log→Data Logging Configure. For help, see the information in the steps on page 82.

To read the data in a data log you have set up, use PAC Manager's Inspect window. See instructions on page 84. To clear all data from a data log, see page 85.

PAC-R EB UIO EIO

Reading or Changing PID Loops

See the steps in "Configuring, Viewing, or Changing PID Loops" on page 166.

PAC-R EB UIO EIO

Reading or Changing PID Module Settings

PID module settings are normally configured in a configuration file (see page 57), although you can also change them in the Inspect window.

To read or change settings on a PID module, with the I/O unit's IP address in the PAC Manager Inspect window, click PID→Module. For help in making changes, see the instructions on page 57.

PAC-R EB UIO EIO

Reading or Changing Events and Event Messages

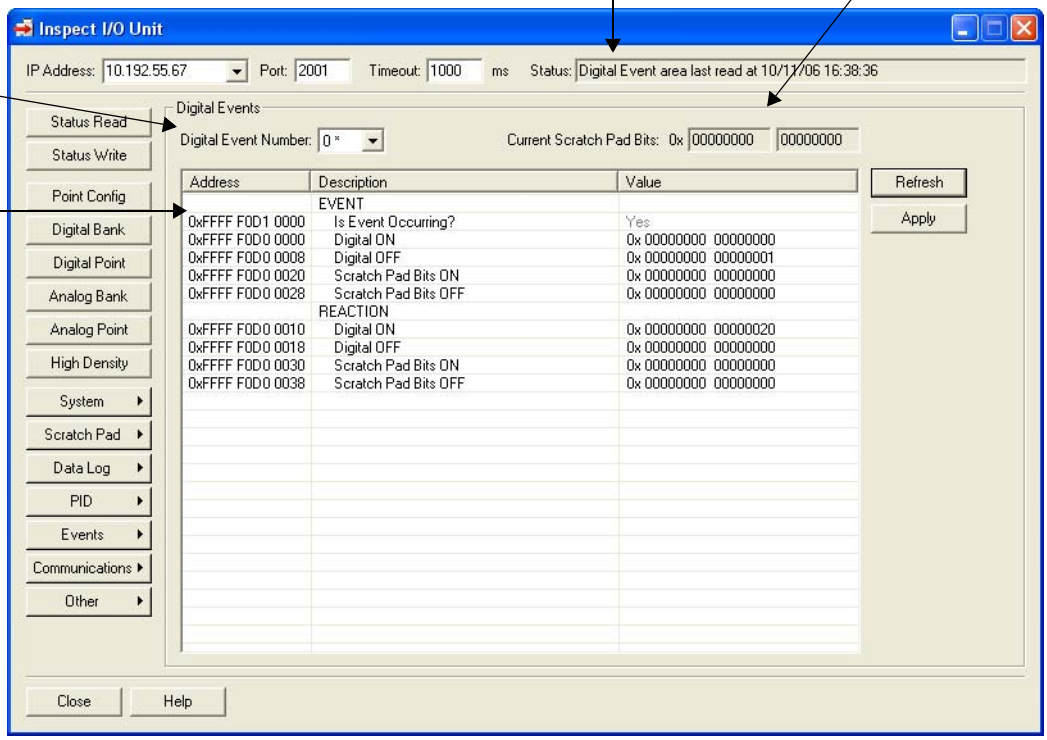
Digital, alarm, serial, timer, and Wiegand events are normally configured in a configuration file. Event messages are configured in a configuration file if you are using PAC Control; otherwise, they are configured in the Inspect window. See Chapter 4, "Setting Up Events and Reactions," for configuration steps on all events and event messages.

However, you can read current events and also change their configuration in the Inspect window. Digital Events are shown below as an example.

The current state of the Scratch Pad bitmask (as of the Status date and time) is shown here.

Choose the event number from the drop-down list.

This event's configuration data is shown here.



For help in understanding or changing event data, see these sections:

Event messages: page 140

Alarm events: page 133

Digital events: page 128

Serial events: page 136

Timers: page 138

Wiegand events: page 136

Reading or Changing Communications and Other Data

Other data on the I/O unit or standalone controller can also be read and changed using PAC Manager's Inspect window. The following table shows where to find the data in the Inspect window and references page numbers in this guide for information to help you understand what you are reading or how to change it:

To read or change	Click this in the Inspect window	For help, see
Security	Communications→Network Security	page 76
PPP	Communications→PPP	page 117
Streaming	Communications→Streaming	page 98
Email	Communications→E-mail	page 93
Modbus	Communications→Modbus	page 106
SNMP Agent	Communications→SNMP	page 90
Serial ports on brain or controller	Communications→Communication Port Control	page 113

In addition, you can read or write to any memory map address by clicking Other→Generic Read/Write. See the memory map appendix in the *OptoMMP Protocol Guide* (form #1465) to make certain you have the correct address before making any changes.

Writing Commands to the Device

Using Hardware Commands

CAUTION: *Hardware commands directly affect the operation or configuration of the device. Be careful when you use them, as they cannot be undone.*

PAC-R
EB
UIO
EIO
SIO
E1
E2

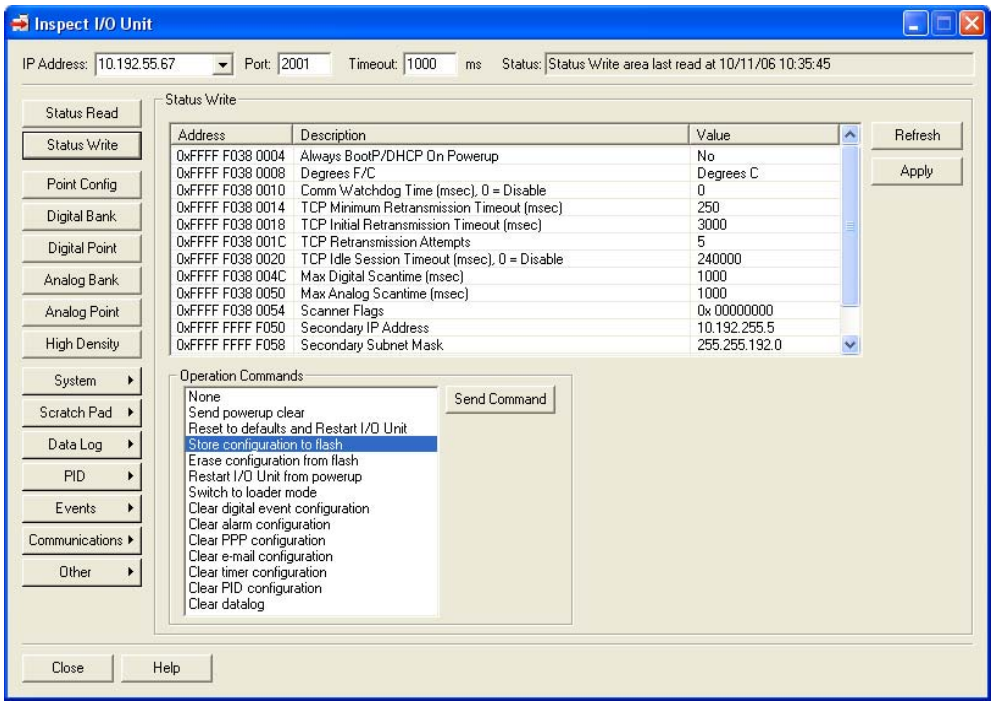
Saving to an I/O Unit's Flash Memory

Saving configuration data to the I/O unit's flash memory makes sure that the data is not lost when power to the unit is turned off.

If you are using a configuration file (as in most of Chapters 2, 3, and 4), you can choose to save configuration data to flash memory when the file is loaded to the I/O unit. However, if you are writing configuration directly to the I/O unit (as in this chapter), you'll need to follow these steps to save to flash.

1. In the PAC Manager main window, click the Inspect button .
2. In the IP Address field, type the IP address of the I/O unit. Click Status Write.

3. In the Operation Command list, highlight Store configuration to flash.



4. Click Send Command.

   The configuration data is stored to flash memory and a Success message appears.

PAC-S
PAC-R
EB
UIO
EIO
SIO
E1
E2

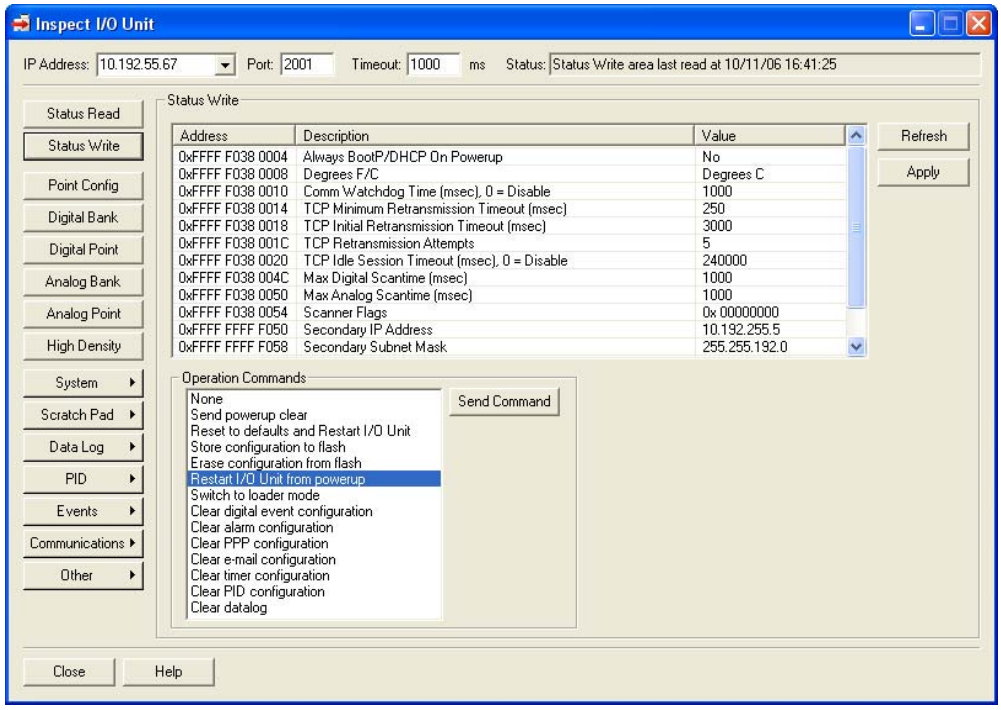
Restarting the Device

Restarting the device is just like turning the power off and then turning it back on again. This command can be used for both I/O units and controllers. For an I/O unit, if configuration data has not been saved to flash memory, restarting resets points to their defaults.

For some configurations to take effect, the device must be restarted. A SNAP PAC controller must be restarted after you configure its secondary IP address, for example. For an I/O unit, if you are using a configuration file (as in most of Chapters 2, 3, and 4), you can choose to restart the unit when the file is loaded to the I/O unit and saved to flash memory. However, if you are writing configuration directly to the I/O unit (as in this chapter), you need to follow these steps to restart it.

1. In the PAC Manager main window, click the Inspect button .
2. In the IP Address field, type the IP address of the device. Click Status Write.

3. In the Operation Command list, highlight Restart I/O Unit from powerup.



4. Click Send Command.

   The device is restarted and a Success message appears.

PAC-REB UIO EIO SIO E1 E2

Resetting Points to Defaults

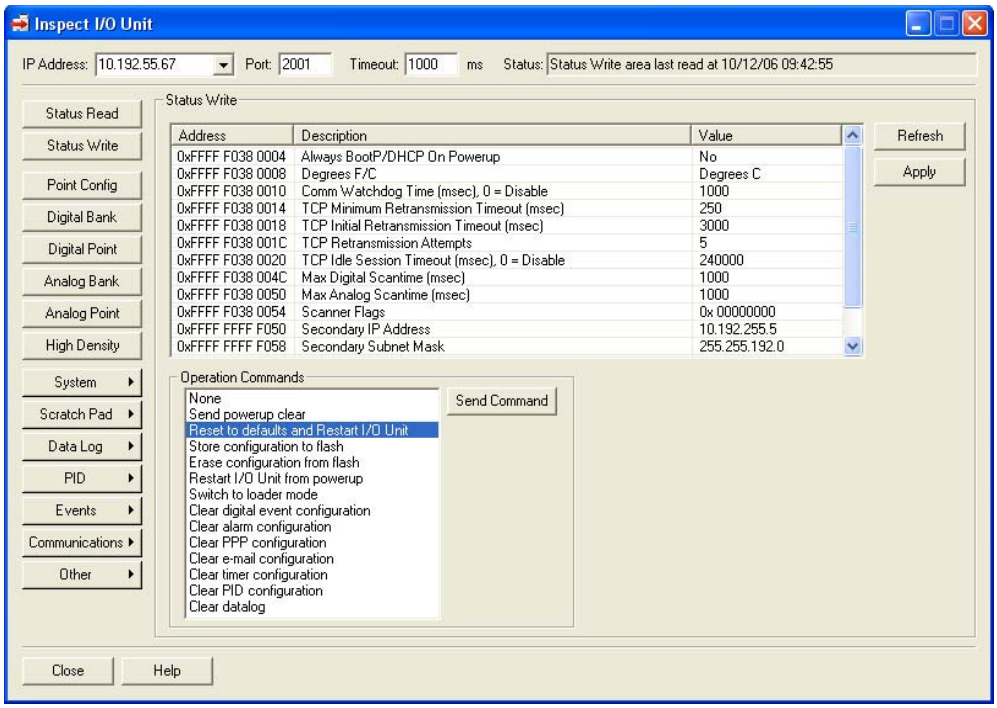
Resetting the I/O unit's points to defaults has the following effects:

- Clears error information in the status area
- Clears offsets and gains, latches, and minimum/maximum data; also clears and deactivates counters
- Turns off digital outputs
- Sets analog outputs to zero scale (0 counts).
- Restarts the I/O unit.

Follow these steps to reset and restart the I/O unit:

1. In the PAC Manager main window, click the Inspect button .
2. In the IP Address field, type the IP address of the I/O unit. Click Status Write.

3. In the Operation Command list, highlight Reset to defaults and Restart I/O Unit.



4. Click Send Command.

   The I/O unit is set to defaults and restarted. A Success message appears.

PAC-REB UIO EIO SIO E1 E2

Sending a Powerup Clear

The powerup clear command clears a flag that indicates the I/O unit has lost and then regained power. Normally a powerup clear command is automatically sent, so normally you won't need to use this command. If you receive a powerup clear error message, however, you can use PAC Manager to send the command. Note that a power loss means that any configuration data not stored to the I/O unit's flash memory has been lost.

1. In the PAC Manager main window, click the Inspect button .
2. In the IP Address field, type the IP address of the I/O unit. Click Status Write.
3. In the Operation Command list, highlight Send powerup clear.
4. Click Send Command.

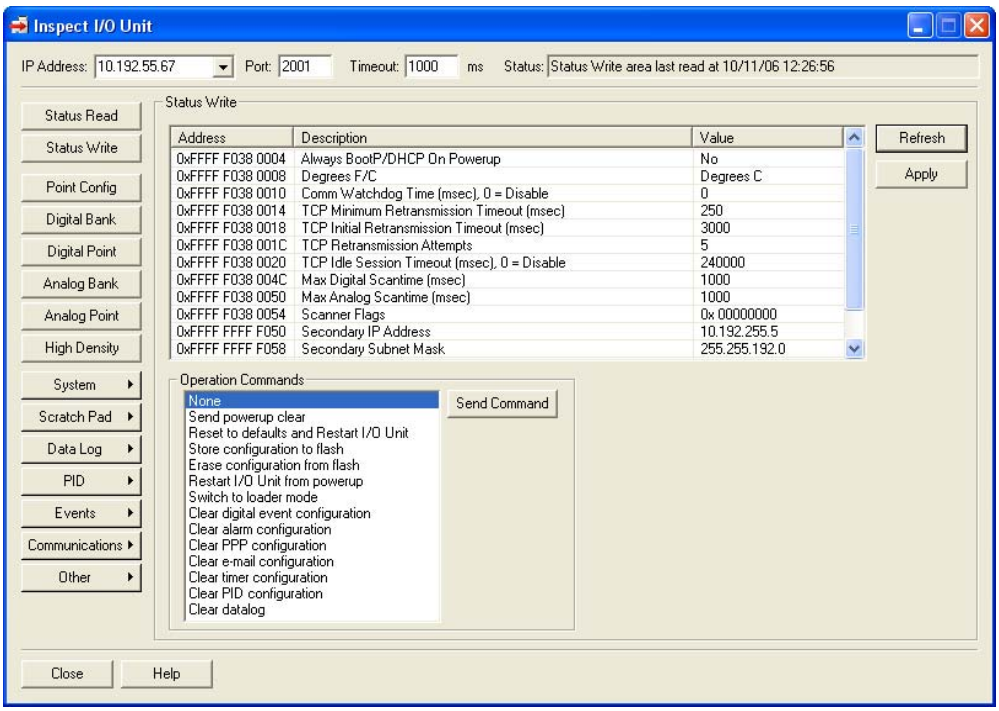
   The powerup clear is sent, and a Success message appears.

PAC-R
EB
UIO
EIO
SIO
E1
E2

Clearing Configurations

You can use PAC Manager to clear the following configurations: I/O point features, digital events, alarm events, timers, email, PID loops, and PPP. (Note that some of these features do not apply to some devices. See the feature chart on page 5.)

1. In the PAC Manager main window, click the Inspect button .
2. In the IP Address field, type the IP address of the I/O unit. Click Status Write.



3. In the Operation Command list, click the configuration you want to clear:
   - Erase configuration from flash (removes configuration data from flash memory)
   - Reset to defaults (see page 187 for more information)
   - Clear digital event configuration
   - Clear alarm configuration
   - Clear PPP configuration
   - Clear e-mail configuration
   - Clear timer configuration
   - Clear PID configuration
4. With the command you want highlighted, click Send Command.

   The command is sent immediately to the I/O unit, and you see a Success message.

Formatting and Interpreting Data

PAC-S
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E2

Data is formatted differently for different addresses in the device's memory map. Starting memory map addresses are shown in PAC Manager; for a complete list of memory map addresses, see form #1465, the *OptoMMP Protocol Guide*. This section shows how to format and interpret various types of data when you are reading or writing to a memory-mapped device.

Mask Data

Some data is in the form of a 32-bit or 64-bit mask—four or eight addresses, each holding eight bits. Each bit in the mask contains the data for one thing in a group: one point, one module, one Scratch Pad bit, etc.

Mask Data for SNAP

For example, most digital bank data (as well as high-density digital module data) is in this form. To read the state of digital points in a bank, you would read the eight bytes starting at FFFFF0400000. Here's how the data would be returned:

At address:	FFFFF0400000								→	FFFFF0400007							
These bit numbers:	7	6	5	4	3	2	1	0	→	7	6	5	4	3	2	1	0
Show data for these points:	3	2	1	0	3	2	1	0	→	3	2	1	0	3	2	1	0
On SNAP modules in these positions in the rack:	15				14				→	1				0			

Therefore, at address FFFFF0400000:

This hex data:	B				1			
Equals this binary data:	1	0	1	1	0	0	0	1
Showing the states:	On	Off	On	On	Off	Off	Off	On
Of these points:	3	2	1	0	3	2	1	0
On these modules:	15				14			

Data from other addresses marked as masks is formatted in a similar way.

Mask Data for E1s

The bank area of the memory map is based on a four-point SNAP module. For I/O units with E1 brain boards, each point is treated as the first point on a SNAP module. That means that when you read a bank of digital points on an E1, data appears only in the first of every four points, like this:

At address:	FFFFF0400000								→	FFFFF0400007							
These bit numbers:	7	6	5	4	3	2	1	0	→	7	6	5	4	3	2	1	0
Show data for these points:	--	--	--	0	--	--	--	0	→	--	--	--	0	--	--	--	0
On G1 or G4 modules in these positions in the rack:	15				14				→	1				0			

So, at address FFFF04000000:

This hex data:	1				0			
Equals this binary data:	0	0	0	1	0	0	0	0
Showing the states:	--	--	--	On	--	--	--	Off
Of these points:	--	--	--	0	--	--	--	0
On these modules:				1				0

These memory map addresses apply not only to G1 and G4 modules, but also to integral racks and even to Quad Pak modules. Points on all E1 I/O units are treated the same way, no matter how they are physically placed on the rack.

Unsigned 32-bit Integer Data

Much of the data in the memory map is in the form of unsigned integers, either one byte, two bytes, or four bytes. With multiple bytes, since the memory-mapped devices use a Big Endian architecture, the high order byte is in the low order address.

For example, digital bank counter data is in 4-byte unsigned integers. It takes four bytes to contain the data for one point. To read digital bank counter data for point 0 on module 0, you would start with address FFFFF0400100. The following table shows the pattern of bank counter data for the first few points on a SNAP rack:

Bytes at these addresses:	FFFFF0400100 FFFFF0400101 FFFFF0400102 FFFFF0400103	FFFFF0400104 FFFFF0400105 FFFFF0400106 FFFFF0400107	FFFFF0400108 FFFFF0400109 FFFFF040010A FFFFF040010B	FFFFF040010C FFFFF040010D FFFFF040010E FFFFF040010F	FFFFF0400110 FFFFF0400111 FFFFF0400112 FFFFF0400113	FFFFF0400114 FFFFF0400115 FFFFF0400116 FFFFF0400117	→
Show data for this point:	0	1	2	3	0	1	→
On the module in this position on the rack:	0				1		→

The most significant byte is at the lowest address. For module 0, point 0, for example, you might receive the following data:

At this address	This binary data	Equals this hex data
FFFF F040 0100	0001 0110	16
FFFF F040 0101	1011 1011	BB
FFFF F040 0102	0001 1000	18
FFFF F040 0103	1000 0111	87

16 BB 18 87

The 32-bit integer for this reading would be **16 BB 18 87** (most significant byte at lowest address). This hex figure correlates to the decimal value 381,360,263.

Remember that if you are processing this data using a Little Endian computer (such as an Intel®-based PC), you must convert the data from the Big Endian format in order to use it. Little Endian format is the opposite of Big Endian; Little Endian places the most significant byte at the highest address.

Digital Point Data (4-Channel Modules)

NOTE: For high-density digital modules, see "Mask Data" on page 190.

For consistency in starting addresses, data for individual digital points has a length of four bytes. However, only the least significant bit contains the data you're looking for.

For example, to read the state of point 0 on module 0, you would start with address FFFFF0800000. Data would be returned as follows:

To read this information:	Point 0 on Module 0: Point State							
Use these addresses:	FFFFF0800000		FFFFF0800001		FFFFF0800002		FFFFF0800003	
These bits:	7 6 5 4 3 2 1 0		7 6 5 4 3 2 1 0		7 6 5 4 3 2 1 0		7 6 5 4 3 2 1 0	
Contain this data (binary):	0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 1	
(hex):	0	0	0	0	0	0	0	1
	Ignore these bits.							Point state is ON.

Digital Point Data for E1s

If you are using I/O units with E1 brain boards, remember that the memory map is based on a four-point SNAP module. For an E1, point data appears in the addresses that correspond to the first of each group of four points. in the memory map, like this:

Addresses for point state:	FFFFF0800F00	FFFFF0800E00	FFFFF0800D00	FFFFF0800C00	FFFFF0800B00	FFFFF0800A00	FFFFF0800900	FFFFF0800800	FFFFF0800700	FFFFF0800600	FFFFF0800500	FFFFF0800400	FFFFF0800300	FFFFF0800200	FFFFF0800100	FFFFF0800000
E1 module position:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Point number:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Point data appears this way for all module types used with an E1: G1, G4, Quad Pak, and integral racks.

IEEE Float Data

For individual analog points, values, counts, and minimum and maximum values for one point are located next to each other in the memory map. All are four bytes and are IEEE 754 floats.

For example, individual analog point data for points 0 and 1 on module 0 appears in these addresses:

Module	Point	Data	Beginning Address	Ending Address
0	0	Scaled units	FFFF F026 0000	FFFF F026 0003
		Counts	FFFF F026 0004	FFFF F026 0007
		Minimum value (E.U.*)	FFFF F026 0008	FFFF F026 000B
		Maximum value (E.U.*)	FFFF F026 000C	FFFF F026 000F
	1	Scaled units	FFFF F026 0040	FFFF F026 0043
		Counts	FFFF F026 0044	FFFF F026 0047
		Minimum value (E.U.*)	FFFF F026 0048	FFFF F026 004B
		Maximum value (E.U.*)	FFFF F026 004C	FFFF F026 004F

* Engineering Units

IEEE 754 float format is as follows:

1 bit	8 bits	23 bits
x	xxxxxxxx	xxxxxxxxxxxxxxxxxxxxxxx
Sign	Exponent	Significand

Float calculation: $(-1)^{Sign} \times [1 + Significand/2^{23}] \times 2^{(Exponent-127)}$

Example for Opto 22 memory map

At this address:	base address			base address + 1			base address + 2		base address + 3	
This hex data:	41			77			33		33	
In binary:	0	100	0001	0	111	0111	0011	0011	0011	0011
In these bits:	31	30 . . . 23		22 . . . 0						
Equals (in decimal):	0	130		7,811,891						
Representing:	Sign	Exponent		Significand						

Decimal $= (-1)^0 \times [1 + 7{,}811{,}891/2^{23}] \times 2^{(130-127)}$

$= 1 \times [1.931] \times 8$

$= 15.45$ (rounded to 2 decimal places)

Analog Bank Data

Remember that the bank area of the memory map is set up for four points per module. Analog modules with more than four points (channels) will show data for points 0–3 only. If the analog modules you are using have only one or two points, the addresses for the upper two or three points in each module will contain the following: for output modules, 0; for input modules, FFFFFFFF.

For example, to read all bank analog point values in scaled units, you would read 256 bytes starting at address FFFFF0600000. Here's how data for two-channel input modules in positions 0 and 1 would appear:

Beginning Address	Ending Address	Data Format	Module	Point
FFFF F060 0000	FFFF F060 0003	four bytes—IEEE float	0	0
FFFF F060 0004	FFFF F060 0007	four bytes—IEEE float		1
FFFF F060 0008	FFFF F060 000B	FFFFFFFF		2
FFFF F060 000C	FFFF F060 000F	FFFFFFFF		3
FFFF F060 0010	FFFF F060 0013	four bytes—IEEE float	1	0
FFFF F060 0014	FFFF F060 0017	four bytes—IEEE float		1
FFFF F060 0018	FFFF F060 001B	FFFFFFFF		2
FFFF F060 001C	FFFF F060 001F	FFFFFFFF		3

On an I/O unit with an E2 brain board, all modules have only one point, so the upper three points would contain 0 (outputs) or FFFFFFFF (inputs).

Maintaining Devices

Introduction

This chapter includes step-by-step procedures for maintaining SNAP PAC controllers and Ethernet-based brains and brain boards, including:

- Viewing and changing IP addresses (below)
- Loading new firmware (See page 197. To find out the current brain firmware version, see "Getting Device and Firmware Information" on page 212.)
- Maintaining files (page 202)

For other maintenance tasks, such as resetting the device to factory defaults or handling a device whose IP address you don't know, see the controller or brain user's guide.

Changing IP Addresses

If you need to change an IP address or subnet mask, you can do so using PAC Manager. You must know the current IP address in order to change it. The white sticker on the device may show the IP address. If not, see the device's user guide for instructions.

PAC-S
PAC-R
EB
UIO
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E1
E2

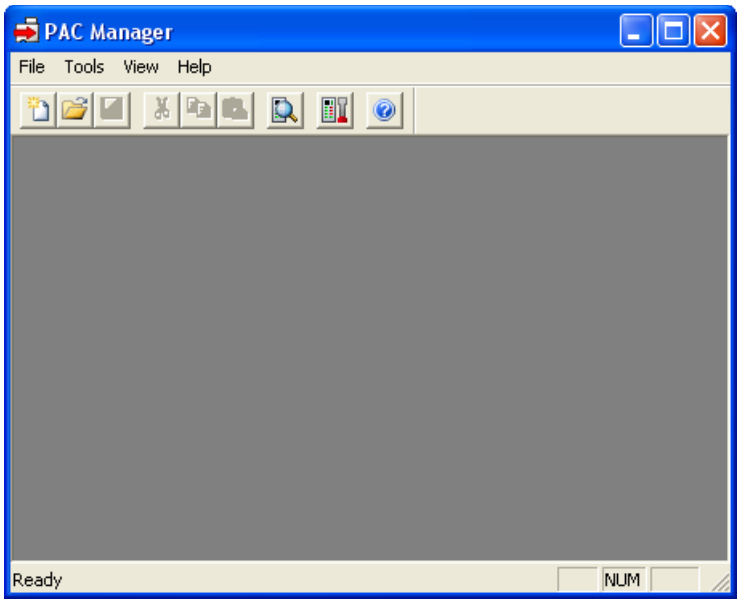
Controllers, Brain Boards, and Brains with Firmware Version 5.0 or Newer

If your SNAP Ultimate or SNAP Ethernet brain has firmware version 5.0 or newer, or if you have a SNAP PAC controller, E1 or E2 brain board, or SNAP Simple I/O brain, use the steps in this section to change an IP address. For SNAP Ultimate and SNAP Ethernet brains with older firmware, see the brain user's guide, form #1460.

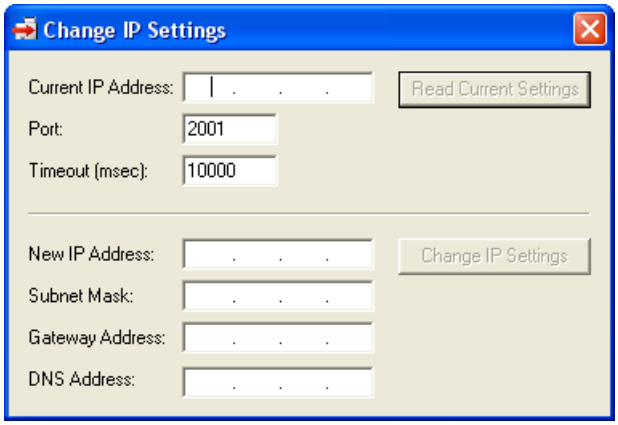
NOTE: This method of changing the IP address uses FTP, which cannot get through a firewall in the PC where PAC Manager is running. Make sure any firewall in the computer (such as the built-in firewall in Windows XP) is disabled before you change the IP address. Firewalls in a router should not be a problem.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

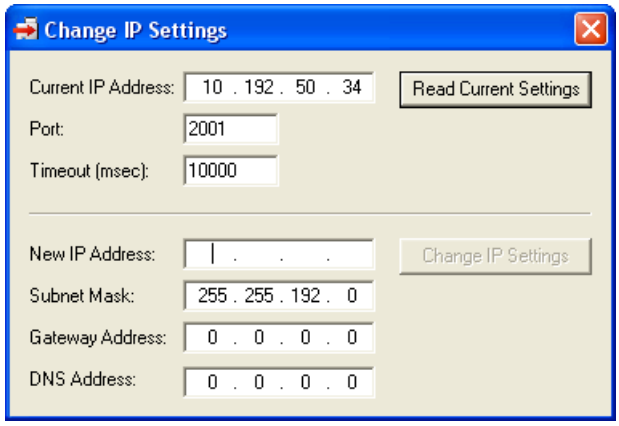
The PAC Manager main window opens:



2. Choose Tools→Change IP Settings.



3. In the Current IP Address field, type the IP address of the device whose address you want to view or change. Click Read Current Settings to see the current subnet mask, gateway address, and DNS address.



4. If you want to change the IP address, subnet mask, or other addresses, enter the new numbers. Make sure you have typed everything correctly. When everything is correct, click Change IP Settings.

   After you confirm the change, a message appears stating that the change was successful and that the device will restart. Restarting may take 10 to 20 seconds to complete. When you see the following indicator, the device is ready for use with its new address:

   – The SNAP-PAC-S1's or SNAP-PAC-R1's STAT LED shows solid green or solid orange when viewed from the top (green means a strategy is running; orange means no strategy is running).

   – The SNAP-PAC-EB1's or SNAP-PAC-EB2's STAT LED shows solid green.

   – The SNAP Ethernet-based brain's STD LED blinks twice.

   – The STAT LED on an E1 or E2 stops blinking and stays on.

   Remember to write the IP address on the sticker or white area on the device.

Loading New Firmware

All Ethernet-based SNAP controllers and brains, and SNAP serial communication modules, contain firmware (sometimes referred to as the *kernel*), which is similar to an operating system. If the firmware should become damaged, or if a new version of the firmware is released, you can load new firmware to the device using PAC Manager.

PAC-R
PAC-S
EB
UIO
E1
E2

Loading Controller, E1, E2, or SNAP Ultimate Brain Firmware

These instructions apply to SNAP PAC controllers, to E1 and E2 brain boards, and to SNAP Ultimate brains that already have firmware version 5.0 or newer.

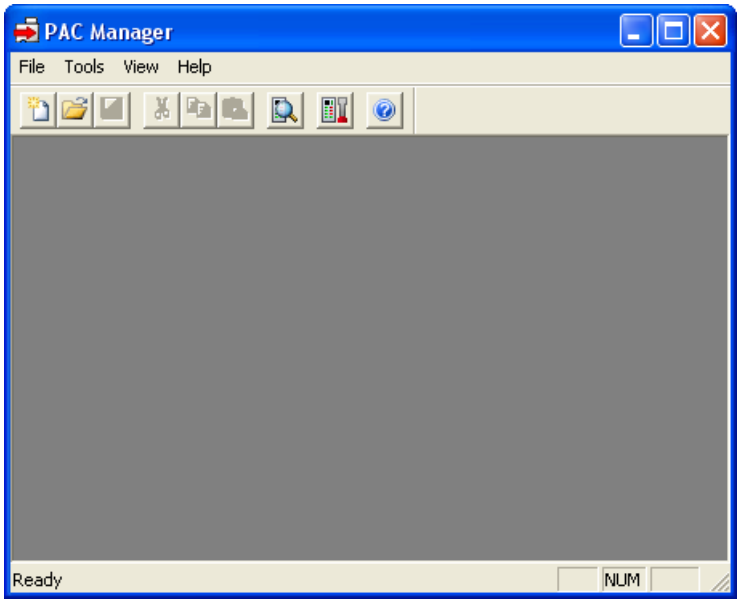
If your SNAP Ultimate brain has firmware older than version 5.0, or if you have a SNAP Ethernet or SNAP Simple I/O brain, see the brain user's guide for instructions.

1. Make sure you have the following before beginning:
   - IP address(es) of the controller(s) and/or brain(s) that will receive the new firmware.
   - New firmware from our website at www.opto22.com. If you have any difficulty obtaining or loading new firmware, contact Opto 22 Product Support. Firmware files are named as follows:

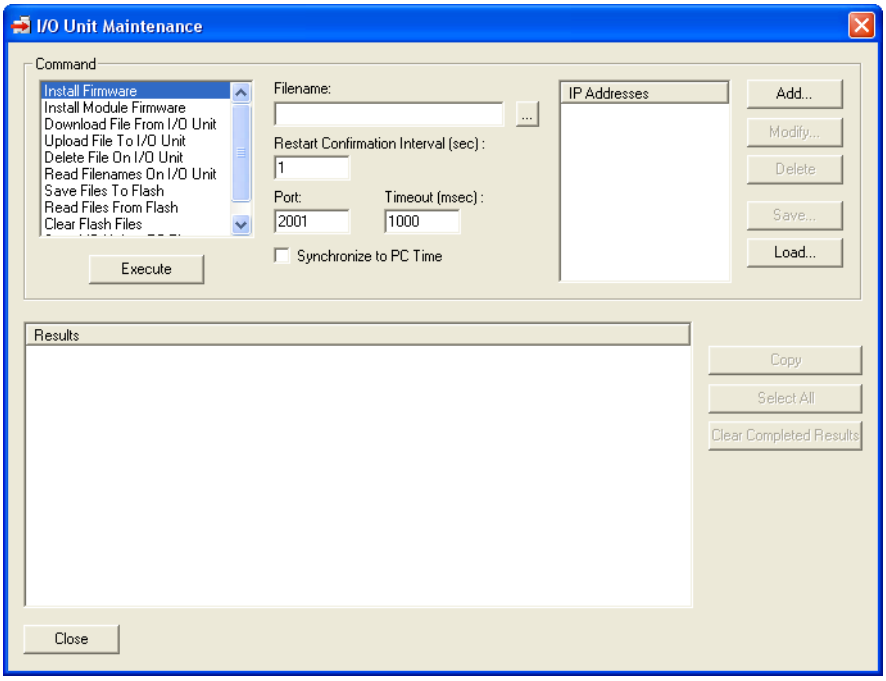
Device	Filename	File extension
SNAP-PAC-S1	contains "S1"	.bin
SNAP-PAC-R1	contains "R1"	.bin
SNAP-PAC-R2	contains "R2"	.bin
SNAP-PAC-EB1	contains "EB1"	.bin
SNAP-PAC-EB2	contains "EB2"	.bin
E1	contains "E1"	.bin
E2	contains "E2"	.bin
SNAP Ultimate brains	contains partial part number	.uio

2. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

   The PAC Manager main window opens:



3. Click the Maintenance button .



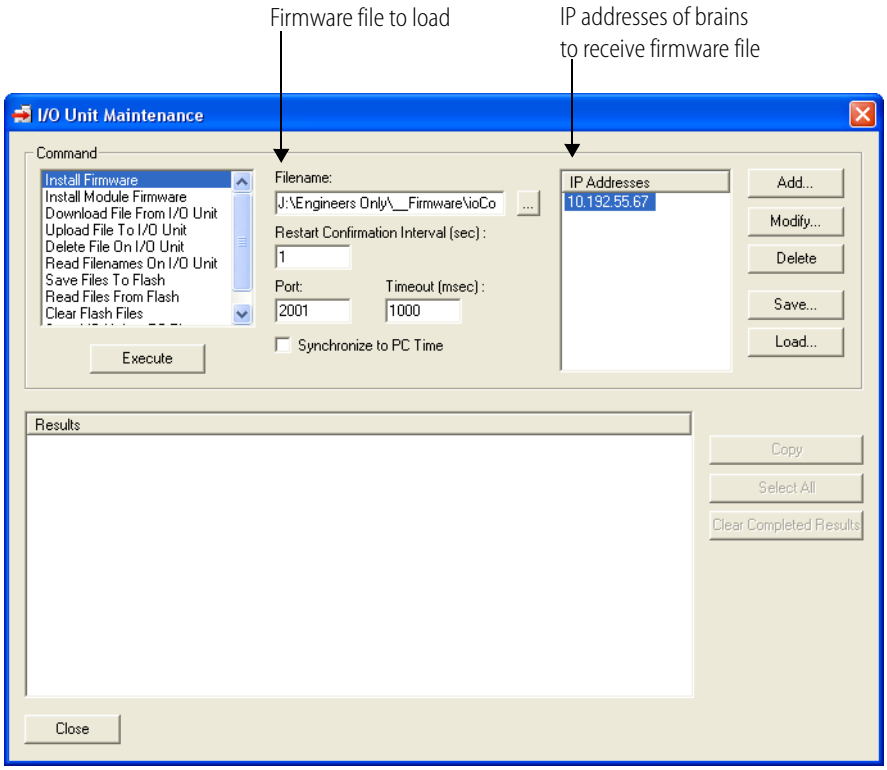
4. Make sure Install Firmware is highlighted in the Command list.
5. Click the browse button ... and locate the firmware file you downloaded from our website. Double-click the filename.

   The path and filename appear in the Filename field.
6. If the IP address(es) of the SNAP devices you want to load firmware to appear in the IP Addresses list, skip to step 8. (Or, if you have previously saved a list of IP addresses, click Load to load the saved list.) If the address(es) you need don't appear in the list, click Add.

7. Enter the address or a range of consecutive addresses, then click OK. (Or, if you are communicating with the device using its host name instead of its IP address, click Host Name and enter the name.)

The address(es) you entered appear in the I/O Unit Maintenance dialog box.

8. In the I/O Unit Maintenance dialog box, highlight the IP addresses to send firmware to.



CAUTION: *If you enter the wrong IP address, you will erase the current firmware in that device. You cannot undo the erase. Make certain you have the correct IP addresses and that you want to download new firmware.*

9. If you have changed the OptoMMP port (see page 76), enter the correct port number. You can also change the number of seconds PAC Manager will wait before verifying that devices have restarted.

10. When everything is correct, click Execute.

The file is loaded to the SNAP devices, and progress is shown in the Results area. When the file is loaded and the devices are restarted, a "Success" message appears.

NOTE: If the download fails on a controller and you have FTP'd files to the controller's file system, there might not be enough file space for the new firmware. To check, choose Start →Programs →Opto 22 →PAC Project Software →Tools →PAC Terminal. Make sure the File Space Available is larger than the size of the firmware file.

PAC-REB UIO

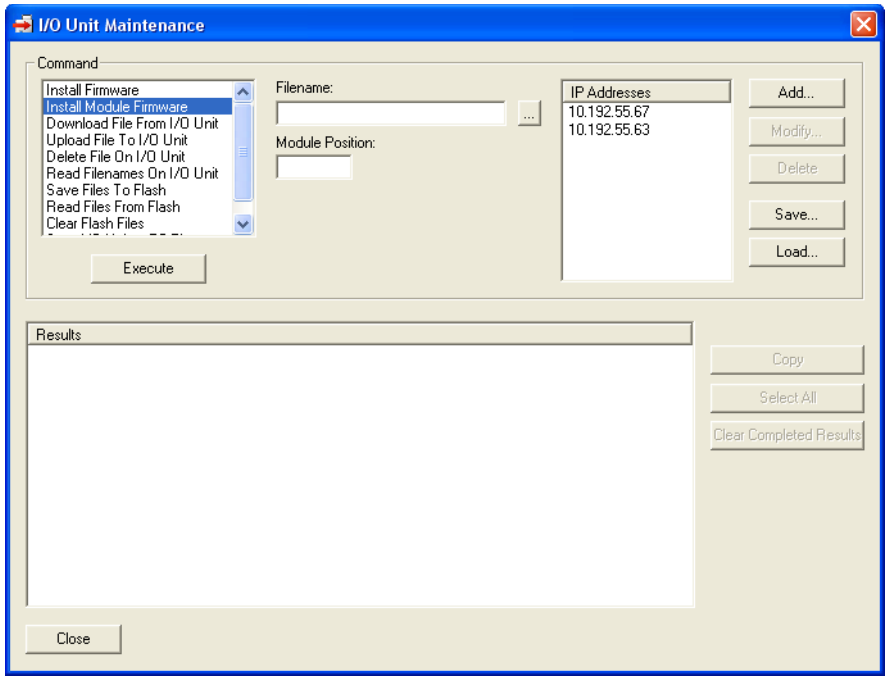
Loading Serial Module Firmware

If you have a SNAP PAC I/O unit, or a SNAP Ultimate I/O unit with firmware version 5.0 or newer, you can load new serial module firmware to a SNAP serial communication module on the I/O unit. (If you want to update the SNAP Ultimate I/O unit to newer firmware so you can use this procedure, follow the steps in its user's guide, form #1460.)

NOTE: If the serial module is on a SNAP Ethernet or SNAP Simple I/O unit, contact Opto 22 Product Support for assistance. Contact information is on page 3.

1. Make sure you have the new serial module firmware file available.

   You can download new firmware files from our website at www.opto22.com. If you have any trouble locating or downloading a firmware file, contact Opto 22 Product Support.
2. If PAC Manager is not already open, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
3. In the PAC Manager main window, click the Maintenance button .
4. In the Command list, highlight Install Module Firmware.



5. Click the browse button ... and locate the serial module firmware file you downloaded from our website. Double-click the filename.

   The path and filename appear in the Filename field.
6. In the Module Position field, type the serial module's position on the rack (0–15).
7. In the IP Addresses list, highlight the IP address of the I/O unit the serial module is on. (If the correct IP address is not shown, click Add to add it.)

You can load serial module firmware to multiple I/O units at the same time, but only if the modules are in identical positions on all I/O units.

8. Click Execute.

   The serial module firmware file is loaded to the I/O unit and then loaded to the serial module, and a Success message appears in the Results area.

Maintaining Files

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This section applies to SNAP PAC and controllers and to SNAP Ultimate controller/brains with firmware version 5.0 or newer. SNAP Ethernet brains, SNAP Simple brains, E1 and E2 brain boards, and Ultimate brains with older firmware do not have file capability. To update a SNAP Ultimate controller/brain to the newer firmware, see the brain user's guide. *NOTE: Form #1564, the E1 and E2 User's Guide, describes the limited use of PAC Manager to FTP specific files to an E1 or E2 I/O unit.*

The memory in a SNAP PAC or SNAP Ultimate controller (firmware version 5.0 and newer) includes a substantial area available for file storage, as shown below:

SNAP-PAC-S1	2.5 MB
SNAP-PAC-R1 SNAP-PAC-R2	2.0 MB
SNAP-PAC-EB1 SNAP-PAC-EB2	2.0 MB
SNAP Ultimate	2.0 MB

Any types of files can be stored in this area, and files can be sorted into directories or folders just as they can on a PC. These stored files are then available for use within a PAC Control strategy or an application you develop. For example, the SNAP device can read the files, add data to them, and even send data from them via FTP to another device on the network.

For information on using PAC Control strategy logic to create and manage files on the SNAP controller or I/O unit, see "Communication Commands" in Chapter 10 of the *PAC Control User's Guide* (Opto 22 form #1700).

There are several ways to manage files. You can use FTP software or even Windows Explorer to move files to and from the device via FTP, and you can use PAC Manager to move and manage files on the device. Here are some additional details:

- **PAC Control** lets you programmatically work with the SNAP controller or I/O unit's file system, within your control strategy. You can create files and folders on the device and write to, add data to, or read them; receive file data via FTP; send all or part of the data in a file via FTP, and more. PAC Control works with one I/O unit at a time. A PAC Control strategy can also FTP files to one or more other I/O units or controllers.
- **PAC Manager**'s main advantage for file management over other commercially available FTP client software is that it can work with multiple devices at once, for example sending data via FTP to ten I/O units at the same time, or deleting the same file from multiple I/O units

simultaneously. Although PAC Manager can read the names of only the folders and files at the root of the device's file system (not the names of files within folders), it can do most operations on any file within the file system. For example, it can delete a file within a folder.

- Newer versions of **Windows Explorer** can be used for FTP operations with a single controller or I/O unit. It's easy to drag and drop files and folders to the device, and you can see the complete file structure. You may find that data isn't always refreshed correctly.
- **Other FTP software** products you can download may be more reliable than Windows Explorer; they also may give you extra features like communication details, which are useful for debugging. Some may not support filenames with spaces or other specific characters. They work with one device at a time.
- You can also use a **command prompt** for FTP, again with one device at a time.
- Note that FTP cannot be used through a firewall in the PC. Make sure any firewall in the computer (such as the built-in firewall in Windows XP) is disabled before you try to work with files. Firewalls in a router should not be a problem, however.

Keep the following limitations in mind as you work with files on controllers I/O units:

Maximum length for filenames and directory names	127 characters
Filename characters allowed	All ASCII characters except `*`, `?`, null, and `/` (Note: some FTP client software may not allow spaces or specific characters.)
Path name component separator	`/`
Maximum number of files and directories that can be open simultaneously	16
Maximum directory depth	Limited only by available memory (Note: PAC Manager reads only the root names; files within folders are not listed.)
Maximum number of files	Limited only by available memory. Each file uses 516 bytes of overhead plus its number of bytes rounded up to the nearest multiple of 516 bytes.
Maximum number of directories	Limited only by available memory. Each directory uses 516 bytes.
Maximum amount of memory available in the device's file system	Approximately 2.5MB on a SNAP-PAC-S1, or 2 MB on a SNAP PAC R-series or EB brain or Ultimate brain (varies slightly depending on the device's firmware version)

When using the SNAP device as an FTP server, for example with an FTP client such as CuteFTP, you can use an anonymous login. The device ignores any user ID or password.

CAUTION: *Make sure you save files to flash memory if needed. If power to the controller or I/O unit is turned off, files are destroyed unless they have been saved to flash.*

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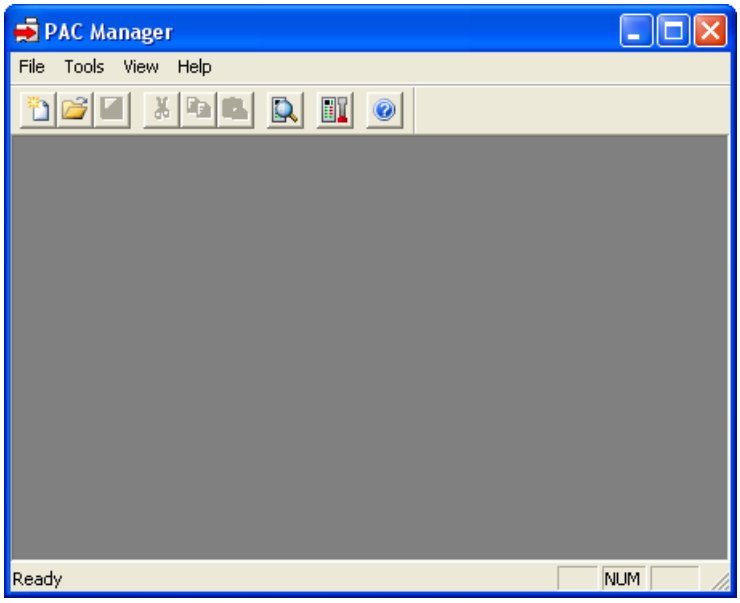
Moving Files to the SNAP Controller or I/O Unit

To move files to the SNAP controller or I/O unit, use any standard FTP client software or PAC Manager. A maximum of five devices can FTP files to a SNAP controller or I/O unit simultaneously.

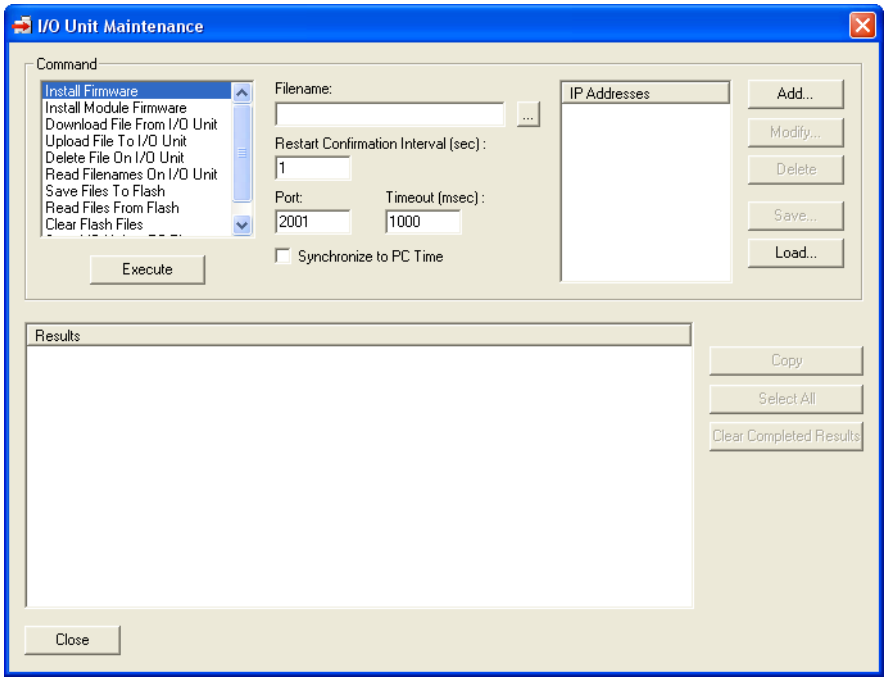
Follow these steps to move files to the SNAP device using PAC Manager:

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.

   The PAC Manager main window opens:



2. Click the Maintenance button .



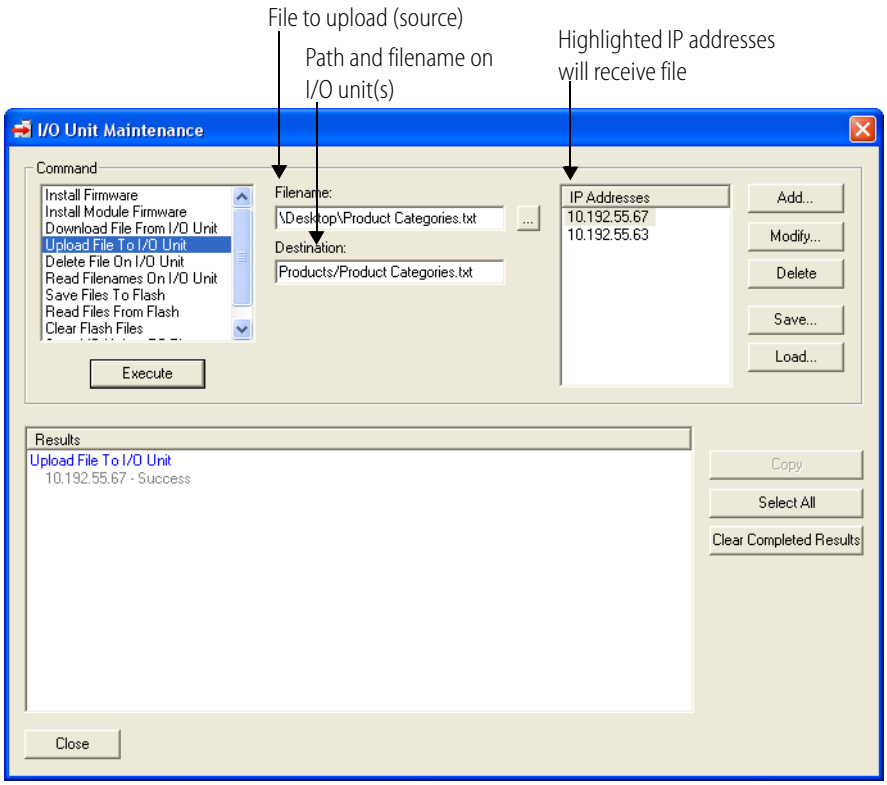
3. In the Command list, highlight Upload File To I/O Unit. Click the browse button ... and locate the source file you want to load.
4. In the Destination field, type the filename as you want it to appear on the SNAP device.

   The filename can be the same or different from the source filename. You can specify a path on the device using the separator / For example, to place the file Product Categories.txt into the folder Products, you would type: `Products/Product Categories.txt` If the folder does not exist, it is created.
5. If the IP address(es) of the device(s) you want to load the file to appear in the IP Addresses list, skip to step 7. (Or, if you have previously saved a list of IP addresses, click Load to load the saved list.) If the address(es) you need don't appear in the list, click Add.

6. Enter the address or a range of consecutive addresses, then click OK.

   The address(es) you entered appear in the I/O Unit Maintenance dialog box.
7. Highlight the IP addresses to load the file to.
8. Click Execute.

The file is loaded to the I/O units, and a Success message appears in the Results area.



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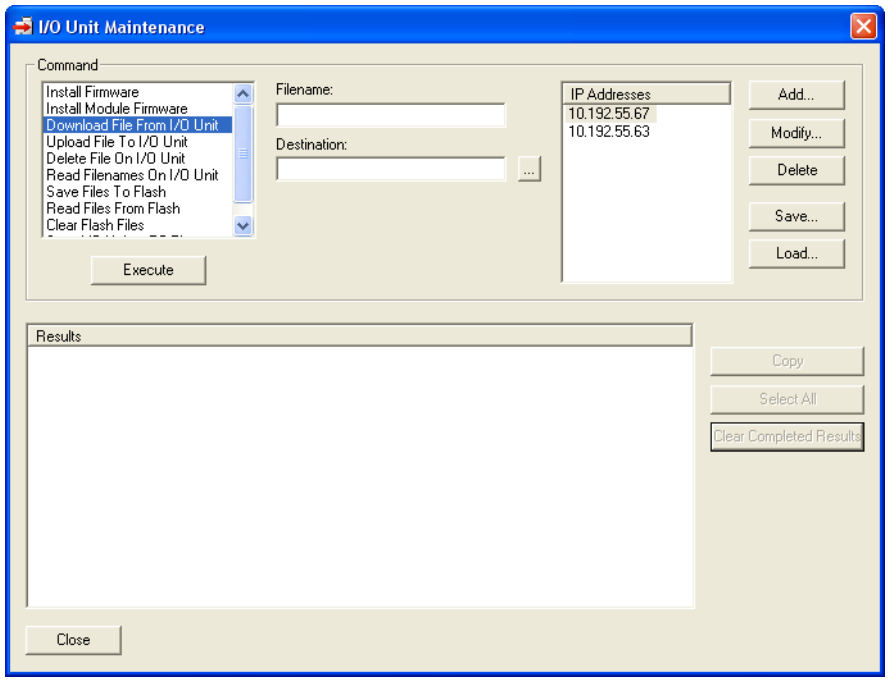
Moving Files from the SNAP Controller or I/O Unit

To move files from the SNAP controller or I/O unit, use any standard FTP client software or PAC Manager, or use the FTP communication handle in a PAC Control strategy. (In PAC Control, a maximum of 16 communication handles can be used simultaneously to FTP files. See "Communication Commands" in Chapter 10 of the *PAC Control User's Guide* for more information.)

Here's how to move files from the device using PAC Manager:

1. In the PAC Manager main window, click the Maintenance button .

2. In the Command list, highlight Download File From I/O Unit.



3. In the Filename field, enter the filename (and path, if any) of the file on the controller or I/O unit.

   For example: `Products/Product Categories.txt`

4. In the Destination field, enter the path and filename where you want the file to go (or click the browse button ... to locate the path, then type in the filename).

   The filename can be the same or different from the source filename.

5. In the IP Addresses list, highlight the IP address of the SNAP device you are downloading the file from. (If it does not appear, click Add to add it to the list.)

6. Click Execute.

   The file is loaded from the device, and a Success message appears in the Results area.

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Reading Filenames

You can use PAC Manager to read and list the names of all files and folders in the root of the controller or I/O unit. Note that files located inside folders (or folders inside folders) are not listed, even though they are there. You can use a standard FTP software program to see them.

1. In the PAC Manager main window, click the Maintenance button .

2. In the Command list, highlight Read Filenames On I/O Unit.

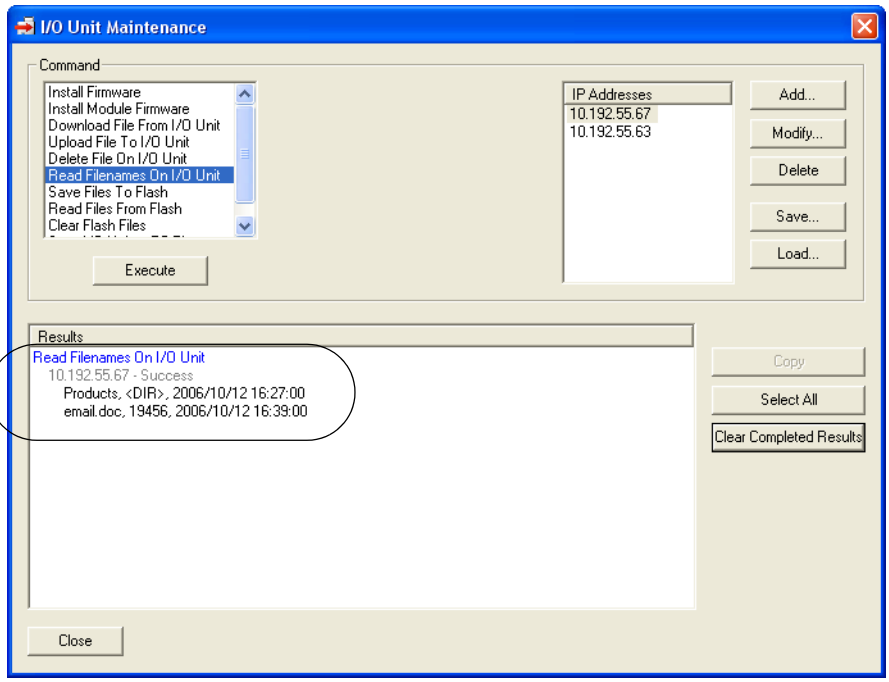
3. In the IP Addresses list, highlight the IP address of the SNAP device you are reading. (If it does not appear, click Add to add it to the list.)

4. Click Execute.

   The list of root file and folder names appears in the Results area.

All root-level files and folders on the device with the IP address 10.192.55.67.

Folders are designated as <DIR>.



The listing shows the file or folder name, the file's size in bytes (or <DIR> for folders), and the date and time it was placed there (in the format YYYY/MM/DD hh:mm:ss).

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Deleting a File from a SNAP Controller or I/O Unit

You can also use PAC Manager to delete a file from one device or from several devices at once.

1. In the PAC Manager main window, click the Maintenance button .
2. In the Command list, highlight Delete File On I/O Unit.
3. In the Filename field, type the filename (and path, if any) of the file you want to delete.

   For example: `Products/Product Categories.txt`
4. In the IP Addresses list, highlight the IP address(es) of the SNAP device(s) you are deleting the file from. (If the correct IP addresses are not shown, click Add to add an address or group of addresses, or if you have saved a list of IP addresses, click Load to load the saved list.)
5. Click Execute.

   The file is deleted and a Success message appears in the Results area.

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Using Flash Memory with the File System

You can use PAC Manager to move files between the controller or I/O unit's file system and its flash memory, which stores files so they are not lost if the device loses power. Remember that flash memory is smaller than the memory available for file storage; check the controller's or I/O unit's data sheet for details.

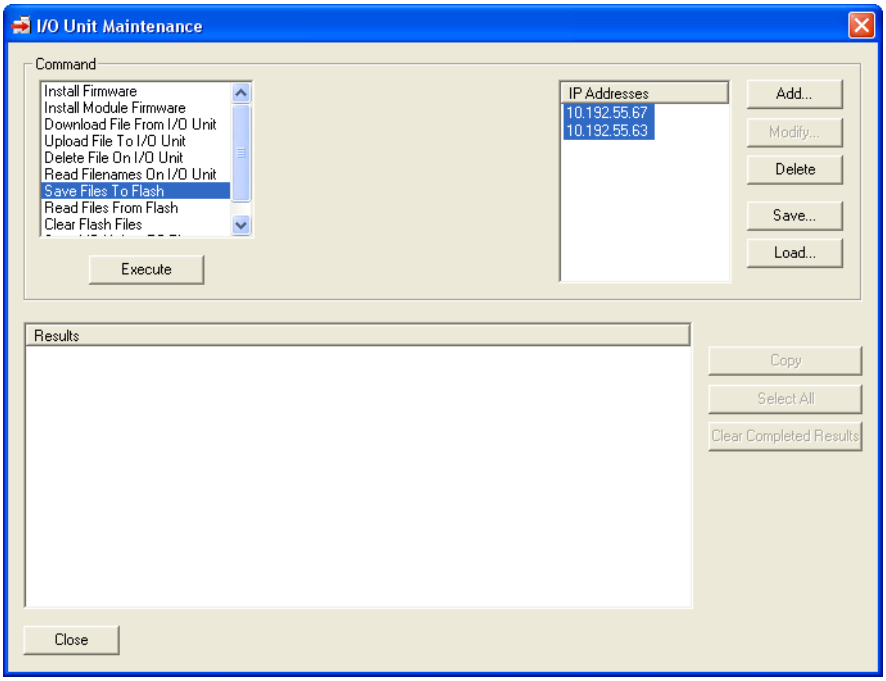
You can do any of the following on one or multiple devices:

- Save all files in the file system to flash memory
- Clear all file system files from flash memory (does not affect firmware, strategy files, or point configuration data)
- Load files from flash memory into the device's file system, replacing all files in the file system

Follow these steps:

1. In the PAC Manager main window, click the Maintenance button .
2. In the Command list, highlight the command you want to use.

   In the following example, Save Files To Flash is highlighted:



3. In the IP Addresses list, highlight the IP address(es) of the device(s) you want the command to apply to. (If the correct IP addresses are not shown, click Add to add an address or group of addresses, or if you have saved a list of IP addresses, click Load to load the saved list.)

   CAUTION: *Make sure you have chosen the correct command and the devices you want to affect. You cannot undo these commands.*

4. Click Execute.

   The command is executed and a Success message appears in the Results area.

Troubleshooting

Introduction

If you are having difficulty using PAC Manager, here are some suggestions that may help. In addition, make sure to check the Troubleshooting section in the device's user's guide. If you cannot find the answers you need in these guides, contact Opto 22 Product Support. Contact information is on page 3.

PAC Manager Error Messages

When you send configurations to I/O units in PAC Manager, you may see the following messages in the lower part of the Send Configuration to I/O Unit dialog box:

Message	Notes
Could not open I/O unit: [IP address] *or* An error occurred while connecting to I/O Unit [IP address].	Timeout error. Check basic communication with the device (See the Troubleshooting appendix in the device's user guide for help).
[number] points successfully configured.	Success message.
Could not configure digital module [number], point [number].	Check the point to make sure it's correct for the module type installed.
Could not configure analog module [number], point [number].	
Module [name] exists at position [number] but was not configured	Check configuration; an analog module is at this position but no points have been configured on it yet.
Could not configure temperature.	These configurations apply to the I/O unit as a whole, not to individual points. Contact Product Support for help. (See page 3.)
Could not configure watchdog.	
Save to Flash—Operation Failed.	Contact Product Support. (See page 3.)
Clear Flash on I/O Unit: [name of unit]—Operation Failed.	
Communication could not be established with the restarted I/O Unit	PAC Manager successfully connected to the device but could not send it a PUC. Check cables and communication.

Trouble Connecting to the I/O Unit or Controller

See the Troubleshooting section in the user's guide for your device:

- SNAP PAC S-series—form #1592, the *SNAP PAC S-Series Controller User's Guide*
- SNAP-PAC R-series—form #1595, the *SNAP PAC R-Series Controller User's Guide*
- SNAP PAC EB brains—form #1690, the *SNAP PAC Brains User's Guide*
- E1 or E1 I/O units—form #1563, the *E1 and E2 User's Guide*
- SNAP Ultimate, SNAP Ethernet, or SNAP Simple I/O units—form #1460, the *SNAP Ethernet-Based I/O Units User's Guide*

Using PAC Manager to Troubleshoot Problems

PAC Manager can be useful in troubleshooting problems with I/O units and controllers. Before calling Opto 22 Product Support, you can use PAC Manager to get device and firmware information. To help with communication problems, you can change TCP settings. You can also check for Ethernet errors, which indicate network problems.

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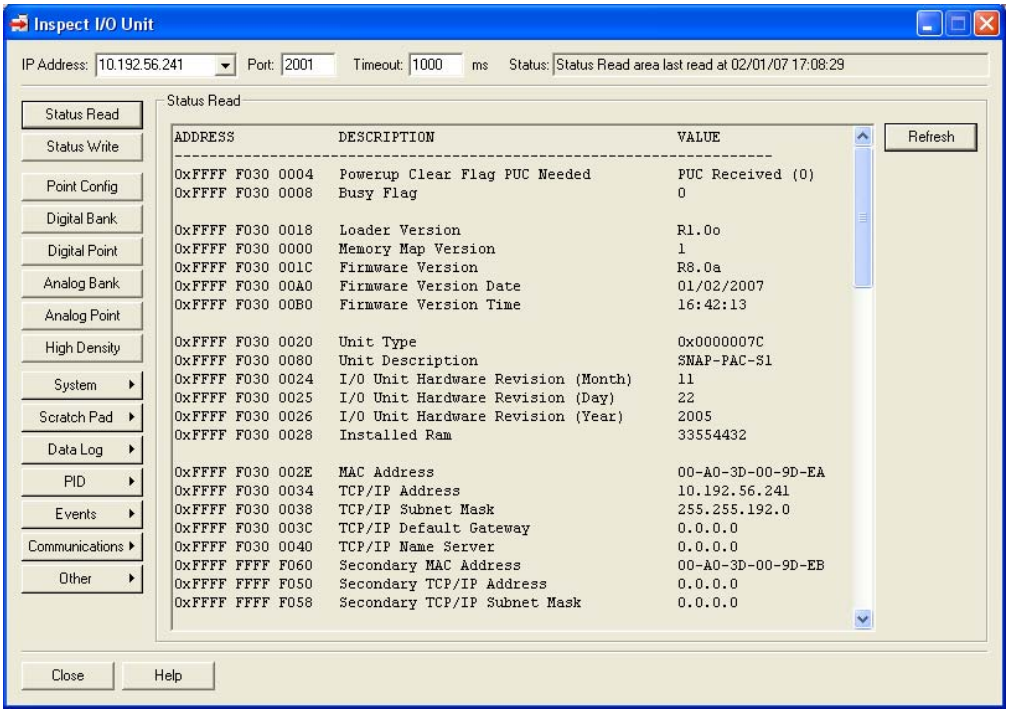
E2

Getting Device and Firmware Information

If you need to contact Opto 22 Product Support for assistance in using an I/O unit or controller, it is helpful to have device and firmware information at hand before you call us.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the Inspect button .
3. In the IP Address field, type the IP address of the device. Click Status Read.

This example shows a SNAP-PAC-S1; other devices are similar.


Inspect I/O Unit
IP Address: 10.192.56.241
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 02/01/07 17:08:29
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
ADDRESS DESCRIPTION VALUE
0xFFFF F030 0004 Powerup Clear Flag PUC Needed PUC Received (0)
0xFFFF F030 0008 Busy Flag 0
0xFFFF F030 0018 Loader Version R1.0o
0xFFFF F030 0000 Memory Map Version 1
0xFFFF F030 001C Firmware Version R8.0a
0xFFFF F030 00A0 Firmware Version Date 01/02/2007
0xFFFF F030 00B0 Firmware Version Time 16:42:13
0xFFFF F030 0020 Unit Type 0x0000007C
0xFFFF F030 0080 Unit Description SNAP-PAC-S1
0xFFFF F030 0024 I/O Unit Hardware Revision (Month) 11
0xFFFF F030 0025 I/O Unit Hardware Revision (Day) 22
0xFFFF F030 0026 I/O Unit Hardware Revision (Year) 2005
0xFFFF F030 0028 Installed Ram 33554432
0xFFFF F030 002E MAC Address 00-A0-3D-00-9D-EA
0xFFFF F030 0034 TCP/IP Address 10.192.56.241
0xFFFF F030 0038 TCP/IP Subnet Mask 255.255.192.0
0xFFFF F030 003C TCP/IP Default Gateway 0.0.0.0
0xFFFF F030 0040 TCP/IP Name Server 0.0.0.0
0xFFFF FFFF F060 Secondary MAC Address 00-A0-3D-00-9D-EB
0xFFFF FFFF F050 Secondary TCP/IP Address 0.0.0.0
0xFFFF FFFF F058 Secondary TCP/IP Subnet Mask 0.0.0.0
Close
Help

Keep this window open on your screen when you call Product Support.

NOTE: Because the Status Read area is used for both standalone controllers and I/O units, some items apply to some devices and not others. The following items do not apply to standalone controllers:

Degrees F/C
Comm Watchdog Time (msec.)
Scanner Flags
Digital Scan Counter
Analog Scan Counter
PID Loops
Smart Modules Present
Arcnet data
Digital resets and failures since powerup

The following items do not apply to E1 and E2 brain boards:

Scanner Flags
Digital Scan Counter
Analog Scan Counter
Milliseconds Since Powerup
TCP Settings
Ethernet Errors
Smart Modules Present
PID Loops
Arcnet data
Ethernet/Digital Resets/Failures since Powerup

For help in interpreting Status Read data, see page 148.

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TCP Settings

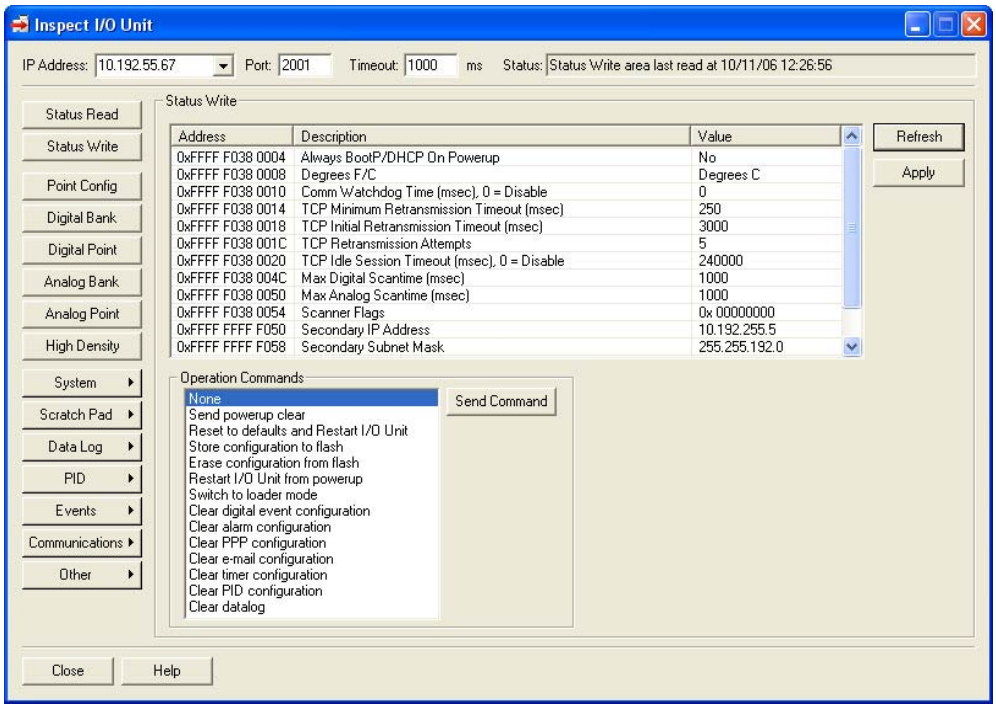
(Does not apply to E1 and E2 I/O units.)

Retransmit timeout (RTO) refers to the length of time the controller or I/O unit waits while communicating before timing out. The RTO is determined by the controller or brain's TCP/IP stack, and the stack continually recalculates the RTO based on recent network traffic. If the network becomes busier, for example, the stack automatically adjusts the RTO to a higher value.

If the TCP/IP stack times out while trying to transmit data, it doubles the current RTO and tries again. This process continues for five retries; after that, the device stops trying and sends a timeout message.

If you are receiving frequent timeout messages from the device, you can change the TCP parameters in PAC Manager.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the Inspect icon .
3. In the IP Address field, type the IP address of the controller or I/O unit. Click Status Write.



CAUTION: *Note the following recommended settings:*

TCP Minimum Retransmission Timeout (msec):	*250*
TCP Initial Retransmission Timeout (msec):	*3000*
TCP Retransmission Attempts:	*5*
TCP Idle Session Timeout (msec):	*240,000*

If you set these fields too low, you may not be able to communicate with the device at all, even through PAC Manager, to fix the settings. Then you would have to reset the controller or I/O unit to factory defaults (see the device's user guide for instructions).

4. Change these four fields as necessary:

   Minimum RTO sets an absolute minimum value for the RTO. The device's calculated RTO will never go below this value.

   Initial RTO sets the RTO for the first communication try. Be careful: since all future tries are based on this value, if you set it too low for network conditions, a connection will never be made.

   TCP Retransmits sets the number of times the device retries communication. Larger, busier networks need a higher number of retransmits than smaller networks with less traffic.

   TCP idle session timeout sets how long (in milliseconds) the device allows a session to remain open without any activity. After this time, the device checks the session to make sure it is still good, and closes it if it is not. The default is 240,000 milliseconds, or four minutes.

5. Click the Apply button to write your changes to the controller or I/O unit.
6. In the Operation Commands list, highlight Store configuration to flash. Click Send Command.
7. In the Operation Commands list, highlight Restart brain from powerup. Click Send Command.

   The new TCP parameters are set.

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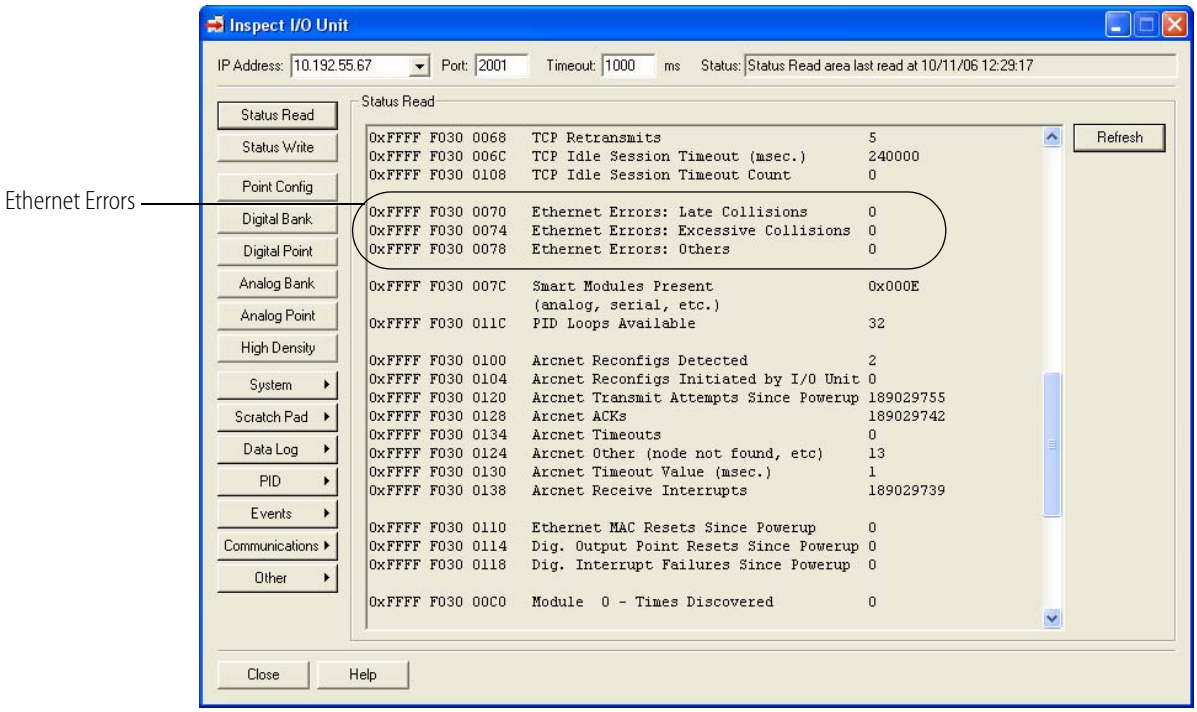
Checking Ethernet Errors

If you are having problems communicating with the controller or I/O unit, follow troubleshooting suggestions in the user's guide for the device.

You can use PAC Manager to check Ethernet errors reported by the SNAP device (not E1 and E2 I/O units). These errors indicate network problems. You will need to know the device's IP address.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the Inspect button .
3. In the IP Address field, type the IP address of the controller or I/O unit. Click Status Read.
4. Scroll down until you see these items:

   Ethernet Errors: Late Collisions
   Ethernet Errors: Excessive Collisions
   Ethernet Errors: Others


Ethernet Errors
Inspect I/O Unit
IP Address: 10.192.55.67
Port: 2001
Timeout: 1000
ms
Status: Status Read area last read at 10/11/06 12:29:17
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Refresh
0xFFFF F030 0068 TCP Retransmits 5
0xFFFF F030 006C TCP Idle Session Timeout (msec.) 240000
0xFFFF F030 0108 TCP Idle Session Timeout Count 0
0xFFFF F030 0070 Ethernet Errors: Late Collisions 0
0xFFFF F030 0074 Ethernet Errors: Excessive Collisions 0
0xFFFF F030 0078 Ethernet Errors: Others 0
0xFFFF F030 007C Smart Modules Present 0x000E
(analog, serial, etc.)
0xFFFF F030 011C PID Loops Available 32
0xFFFF F030 0100 Arcnet Reconfigs Detected 2
0xFFFF F030 0104 Arcnet Reconfigs Initiated by I/O Unit 0
0xFFFF F030 0120 Arcnet Transmit Attempts Since Powerup 189029755
0xFFFF F030 0128 Arcnet ACKs 189029742
0xFFFF F030 0134 Arcnet Timeouts 0
0xFFFF F030 0124 Arcnet Other (node not found, etc) 13
0xFFFF F030 0130 Arcnet Timeout Value (msec.) 1
0xFFFF F030 0138 Arcnet Receive Interrupts 189029739
0xFFFF F030 0110 Ethernet MAC Resets Since Powerup 0
0xFFFF F030 0114 Dig. Output Point Resets Since Powerup 0
0xFFFF F030 0118 Dig. Interrupt Failures Since Powerup 0
0xFFFF F030 00C0 Module 0 - Times Discovered 0
Close
Help

All three of these items should have a value of zero. If any of these items has a value other than zero, you may have a network problem.

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